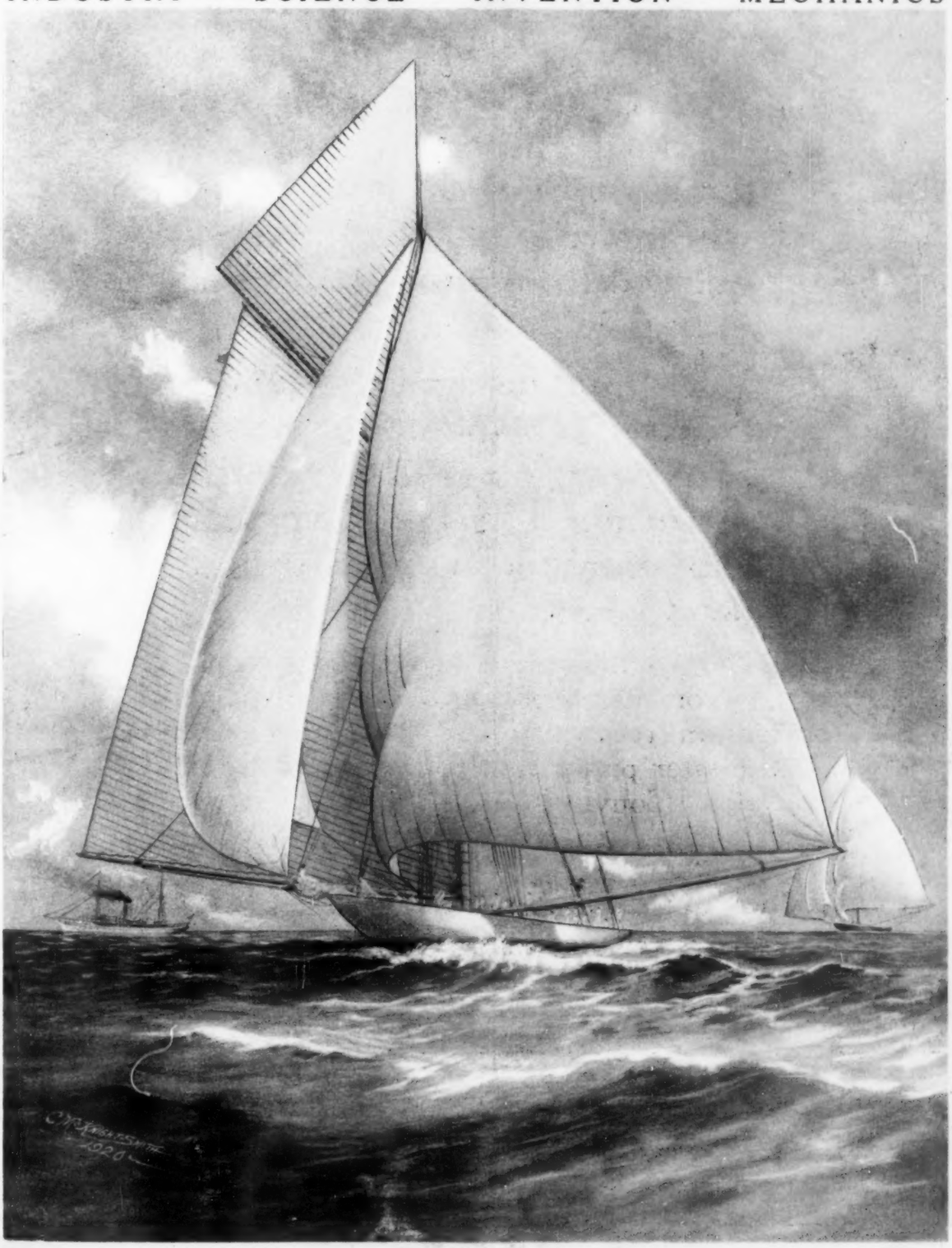
SCIENTIFIC AMERICAN

A Weekly Review of Progress in

INDUSTRY · SCIENCE · INVENTION · MECHANICS



DOWN THE WIND WITH EVERYTHING SET.—[See page 64]

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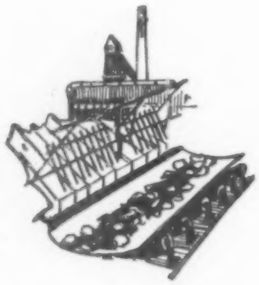
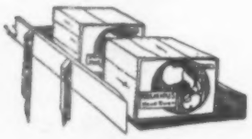
"Convey by Belt"



THE progressive man does not transport his raw material or finished product by wheelbarrow or hand when railroads or motor trucks are available.



Yet within his own plant there are relatively short hauls where conveyor belts can handle materials in greater volume and more economically than hand labor.

Our engineers who specialize on conveyor belt problems will demonstrate upon request how you can secure greater production at lower cost when you "Convey by Belt."

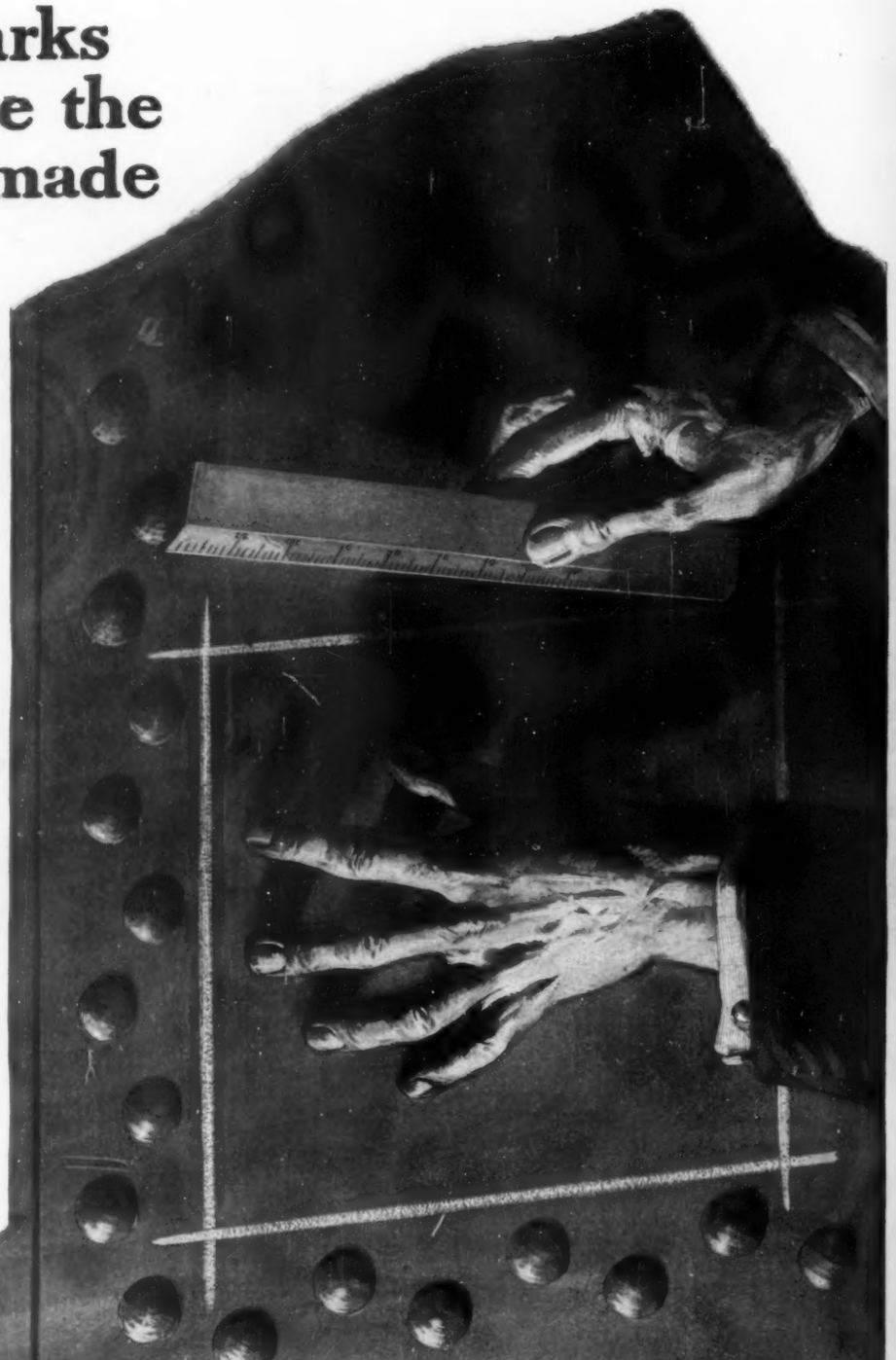
United States Rubber Company

The World's Largest and Most Experienced Manufacturer of Mechanical Rubber Goods

BELTING	HOSE	PACKINGS	MISCELIANEOUS
Transmission *"Rainbow," "Pilot" "Shawmut"–"Giant Stitched"* **Conveyor** *"United States," "Grainster"* **Elevator** *"Matchless" "Granite," "Grainster"* **Tractor** *"Sawyer Canvas" "Little Giant Canvas"* **Agricultural** *"Rainbow," "Bengal" "Grainster," "Sawyer Canvas"*	**Air** *"4810," "Dexter"* **Steam** *"Rainbow," "Giant," "Perfected"* **Water** *"Rainbow," "Mogul," "Perfected"* **Suction** *"Amazon," "Giant"* **Garden** *"Rainbow," "Mogul," "Lakeside"* Also Hose for Acetylene, Oxygen, Acid, Air Drill, Auto Radiator, Car Heating, Air Brake, Gasoline, Oil, Hydraulic, Chemical, Coke, Creamery, Discharge, Vacuum, Sand Blast, Spray, etc.	**Sheet** *"Rainbow," "Vanda," "Paramo"* **Rod** *"Wizard," "Rainbesta," "Peerless," "Honest John," "No. 573" and hundreds of other styles in coils, rings, gaskets and diaphragms —* **Usco Valves —** THE RIGHT PACKING IN THE RIGHT PLACE	**Mats, Matting and Flooring, Plumbers' Specialties, Rubber Covered Rolls, Friction Tape, Splicing Compd. Dredging Sleeves, Hard Rubber Goods, Printers' Blankets, Tubing, Soles, Heels, Jar Rubbers, Moulded Goods**

UNITED STATES RUBBER COMPANY
US
RUBBER SYSTEM
AND ASSOCIATED COMPANIES

The Square marks the spot where the escape was made



RIGHT through steel plates, mocking the rivets, without noise or clue, one thousand pounds of coal escaped from within this chalked square last year. It escaped as valuable heat bought and paid for—horse-power that never did a tap.

Now a square foot isn't very large, just large enough to suffer being overlooked in the average place where heat is used. But when you add up the small isolated areas, fractions of square feet in a power plant or factory, or even in a cellar heating plant, the total is enormous. It stands as wasted coal, more often amounting to tons rather than pounds.

In money it is often staggering, and so unnecessary because so readily corrected if intelligent knowledge of insulation is called in to correct it.

From the buyer's viewpoint, an insulation service should be able to answer this basic question: How much money return, based on heat savings, can I expect through an investment in insulation of this or that kind?

It is the answer to this that Johns-Manville Insulation Service is able to provide.

Through scientific investigation controlling manufacture and application of insulations, any condition can be met and corrected with certainty and savings computed even before the work is started.

Insulation is one of the most important departments of our business, and has been for over fifty years. Today this is a national service, not only completely equipped with materials for every industrial condition, but including as well contract departments in all our Branches for the application of these materials.

H. W. JOHNS-MANVILLE CO.
Madison Ave. at 41st St., New York City
10 Factories—Branches in 64 Large Cities
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COVERS THE CONTINENT

Through—

Asbestos
and its allied products

INSULATION
that keeps the heat where it belongs
CEMENTS
that make boiler walls leak proof
ROOFINGS
that cut down fire risks
PACKINGS
that save power waste
LININGS
that make brakes safe
FIRE PREVENTION PRODUCTS

JOHNS-MANVILLE
Serves in Conservation

SEVENTY-SIXTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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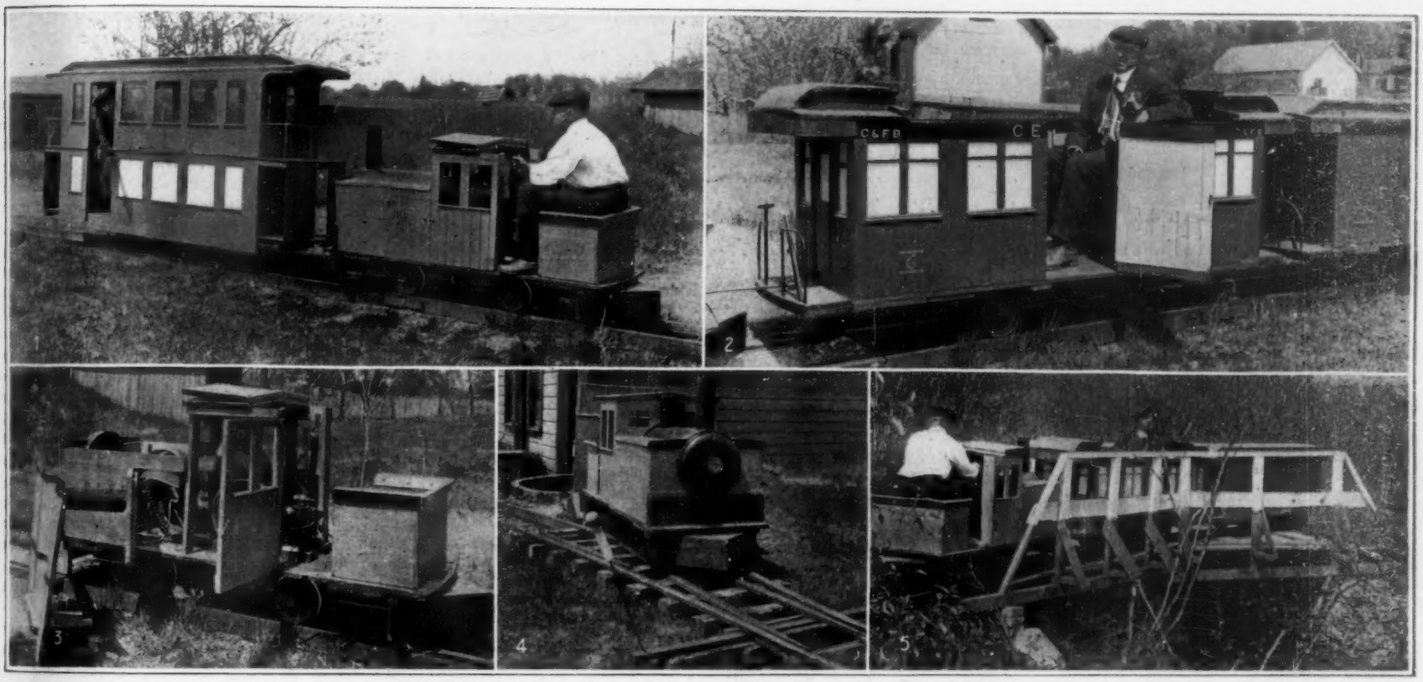

1 The engine hauling the double-decker car—the last word in rolling stock for this interesting line. 2. The passenger cars look quite like the real thing, but their interior arrangements are slightly different. 3. Showing some of the details of the locomotive, with its gasoline engine. 4. A one-car passenger train leaving the roundhouse. 5. A bit of rural scenery where the road crosses the brook.

Toy railroad of much utility built as a hobby from old lumber by a New York farmer

A Tiny Railroad, at Once a Toy and a Tool

WHEN the city man sets himself up on the farm, either upon his retirement from active business or in connection with the establishment of a summer residence, he seldom confines his attention to mere farming. Something in the way of a side-line is bound to catch his fancy and lead him on until the farm itself has become more or less a side-line, while the original passing notion is the serious business of the estate.

Few gentlemen farmers, however, can boast a hobby as unusual as that of Mr. W. C. Gage, who a couple of years ago gave up his activities as a New York broker to enjoy the peace and quiet of his farm up the state. Mr. Gage found that the facilities for local communications between the several parts of his farm were not of the best. He also found that he had an abandoned chicken house about 250 feet long, which was thoroughly useless as a chicken house and in which the lumber was beginning to deteriorate. So he proceeded to kill three birds with one stone by using this lumber to renew the lines of transportation, and to have a bully lot of fun in the bargain.

The pictures show the miniature railroad—we cannot properly call it a play railroad because, while Mr. Gage plays with it a lot, it also does a lot of the serious business of the farm—at any rate, the pictures show what Mr. Gage made from his old hen house. He laid wooden rails to all sections of the farm, built a few tiny cars of various types, and set to work on an engine to pull these. It will be seen that while the engineers and the passengers occupy rather unconventional accommodations in the various units of rolling stock which make up Mr. Gage's equipment, these units are all got up, externally, to carry out the illusion of regular railroad stuff.

The locomotive is no dummy at all; it mounts a four-horse-power gasoline engine, which is ample to pull the cars at a decent speed over the rails which are supplied for the purpose. It is built for service rather than style, so the engineer has to imitate the oarsman and ride with his back toward the place to which he is going; but that is no great drawback. The passenger cars are capable of carrying two passengers each; and one double-decker car, with glass windows and all the other trimmings, is altogether de luxe.

Mr. Gage's road possesses, in addition to the passenger-carrying equipment, box cars and flat cars of ample size and in ample numbers to do all the hauling business of the farm, and to do it efficiently—in fact, he insists that his hobby justifies its existence in this manner. During the week he travels about the farm gathering up the produce and distributing manure and other necessaries: then on Sundays and holidays he totes the admiring visitors about in his miniature trains. Bridges, cross-ties, signals, and everything else that can add to the railroading atmosphere are to be found here—and all of wood, all home-made by Mr. Gage right on the spot.

Stained Glass Once More in Vogue

ALL the valuable stained glass windows were removed from the large churches in Paris in order to protect them against air raids and destruction by long range gunfire, during the war. The windows were stored in safe places and remained unharmed. They are now to be carefully retouched and renovated and then to be reinserted. These windows total approximately 470,000 square yards of stained glass, and their renovating will take a long time and will be of considerable expense.

A wide and remunerative scope of work has thus been opened to the Paris Association of Glass Stainers, some members of which are noted artists. Although this association and some other guilds of glass stainers work entirely in a mediaeval craft it would be wrong to conclude that their methods are behind the times. Fifty years ago the old secret of staining glass, which was lost with the decline of art in the 17th and 18th centuries, was rediscovered and, with the aid of chemistry, has made remarkable progress. This is shown by the fact that today the glass stainer disposes of over 5,000 different pigments, while in the 12th century, the golden age of glass staining, only twelve colors were known.—By *J. E. Boos.*

For Spark Plug Electrodes

THE use of cements for sealing electrodes into spark plug porcelain has been found to be attended by serious difficulties in high temperature engines such as airplanes. Among these are: promotion of oxidation and destruction of the electrode wires by reactions taking place in the cement and between the cement and electrode wires; breaking of spark plug porcelains caused by difference in coefficients of thermal expansion of electrode wires and porcelain, and cracking of cement, with consequent gas leakage, due to the same cause. A cement composed of silicate of soda and raw kaolin has been found to give little trouble from chemical action. In order to avoid the difficulties attending the use of any form of cement, the use of a mechanical seal at the top of the porcelain has been tried with promising results. Those interested are referred to Technologic Paper No. 155 of the Bureau of Standards, "Cements for Spark Plug Electrodes," which is now ready for distribution and any one interested may obtain a copy by sending a request to the Bureau.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

The All-Metal Monoplane

THE recent 1,400-mile non-stop flight on an all-metal passenger-carrying monoplane is notable, both because of the distance covered and because of the special design and materials of the machine. The all-metal monoplane has particular interest for this journal, for the reason that as far back as 1910, the SCIENTIFIC AMERICAN published its own design for a racing monoplane, built entirely of high-grade alloy steel. The article was inspired by a study of the highest types of airplanes of that period, as represented in the celebrated meet, ten years ago, at Belmont Park, all of which, including even the fast Blériot monoplane, were so encumbered with wire and wood struts and ties, to say nothing of the elaborate landing gear, as to present a large and, as it seemed to us, unnecessary amount of head resistance. It was our conviction that by the use of steel construction throughout and by the adoption of the monoplane type, it would be possible to give the wings sufficient thickness for the insertion within them of transverse beams of sufficient depth to provide the necessary bending strength, thereby getting rid of all exterior trussing. The body of the machine was of oval cross section and streamlined, and in place of linen the wings and the body were covered with very light corrugated steel plating. The landing gear folded against the under side of the body when the machine was in flight, and automatic stability was secured by means of a compressed air cylinder, whose movements, controlled by a gyroscope, actuated the ailerons.

The suggestion was ahead of its day, but with the coming of the wonderful aluminum alloys that are now available, the design took practical shape, and toward the close of the war the Germans built some very successful monoplanes, which dispensed entirely with wood and linen fabric, depended for their wing strength on internal trussing, and were covered as to wings and body with thin corrugated aluminum plating. We believed then and we are still of the opinion that the fastest machines of the future will be of the monoplane type.

The Scientific Basis of Sport

CONSTANTLY we refer, in speech and in writing, to the human mechanism and the human machine, or use some metaphor that draws analogy between the human body and the structure of metal, stone and wood. Often too we reverse the figure and speak of a machine that seems almost to be endowed with human intelligence. But when our little flight of rhetoric has served its purpose, we lapse back into a state of mind where we recognize that of course a man and a machine are two fundamentally different things. It were trivial to catalog the many distinguishing points that separate the human from the mechanical; but we may single out one of these points for purposes of adorning a tale.

We never design or install a machine of any consequence without considering carefully what it will do. Always there are understood to be certain things that a machine will do, and certain other things differing only in degree but which it will not do. It will travel 60 miles per hour but not 80. It will haul a load of 50 tons but not one of 75. It will turn out 10 tons of concrete mix an hour but not 11.

We go further than might necessarily appear on the surface of these remarks. We assume that under like operating conditions the machine will give like performances. We assume that if it will make 60 miles an hour today it will do the same tomorrow and next week and throughout its useful life. This may not seem to be an assumption—it may appear founded upon the immutable laws of cause and effect. But if we will compare the machine with the man on this basis of constancy of performance, we will see that we make an assumption, and a very material one, when we ask the machine to do a thing today merely because it did that thing yesterday.

As we write, Mr. Hagen has just lost out in his effort to annex the British golf championship. Four times he propelled the little white sphere over the landscape at Deal. Once he had to hit the ball 84 times to produce the desired results; again he required 82 strokes; twice he got around in 78—all over the same course. Duncan, the ultimate winner, on the second day negotiated the 36 holes in 143 strokes as against 160 which he used up the day before. No record of the occasions on which Hagen has turned in a better performance or Duncan a worse one is needed to establish the fact that what a man does today in golf, tomorrow he may repeat and he may not.

Again, as we write, Mr. Tilden has just taken unto himself the championship of the world in the game to which he devotes his attention—tennis. In doing this he had to defeat Mr. Parke, who had the day before beaten Mr. Johnston, who last year beat Mr. Tilden decisively for the American title. In the same tourney, Williams and Garland, on all performances of the past by far the weaker of the American teams, took the doubles title right out of the grasp of no less formidable a combination than Tilden and Johnston. On the basis of previous performances who would have dared predict all this? Who would be rash enough to assert that if the tourney were played over, the same results would be attained?

A couple of weeks ago the Brooklyn baseball club went to Boston for six games and lost five of these. They have just returned from a second invasion of the hub, during which they played and won four games. And because this morning's papers narrate how the club that represents New York in the other league scored 14 runs in a single inning against Washington does it follow that they will win the next time they face the same pitcher?

We have paraded these examples of human mutability from the field of sports because it is in the field of sports that we shall draw our moral. The fact remains, we can never predict that because a human being has done a thing he will do it again when he tries it again. The causes which contribute to a good or an average or a poor showing in any intensive human effort are so very many and so very complex that they defy analysis and prediction alike.

After all, isn't it better thus? Where would the zest and the competition in sport be if we could say "Well, A beat B last year, so B doesn't stand a chance against him now." There would not be any competition at all, except between "maidens," if we may borrow a term from the sport of kings. After a newcomer in any field of sport had met all the leading players, his place would be immutably fixed, and he could experience the real thrill of uncertainty, the real zest of competition where the result is at issue, only against other newcomers. So from the point of view of real sport, it is mighty fortunate that the human mechanism does not "run to form" like a true machine, and that constancy of performance is something to which no human can do more than achieve a rough approximation.

The Folly of a Divided Fleet

WHATEVER political expediency there may have been in dividing our fleet between the Atlantic and the Pacific, from the standpoint of military efficiency, national defense, and economy, it was one of the most faulty moves ever made in the administration of the United States Navy.

A strong statement—but having behind it the Navy's greatest strategical authority; for in 1912, Admiral Mahan said: "To divide the battle fleet would be the most entirely suicidal act that could be contemplated."

The results of dividing the fleet are bad at best, and positively disastrous at the worst. In the first place, a divided fleet practically doubles the requirements for flagships, supply vessels, tugs, targets, flag officers and staffs, shore bases—in fact for everything which in business would be known as overhead expense. By combining the two fleets and reducing the ships and staffs now duplicated we should save several hundred officers, several thousand men, reduce Government expenditures by several million dollars and greatly increase the efficiency of the Navy.

Again, divided fleets develop doctrines and ideas independently of each other, according to the admiral in command. When the fleets come together for combined exercises, they do not readily amalgamate, for their training has differed. You could not throw the Princeton and Yale football teams together overnight and expect them to play an efficient championship game with Harvard the next day. Team work in a great fleet can be obtained only as a result of long practise. Neither half of a divided fleet is as big as the combined fleet would be in war. Therefore, during peace the Commander-in-Chief is not obtaining the training he should have in handling and maneuvering the large number of vessels that would be under him in war time. An occasional assembling of the two fleets under one command would never provide the requisite training. It should be continuous throughout the command of the Commander-in-Chief.

When the fleet was divided several fallacious arguments were offered in support of the move; but the claim that competition is stimulated by having two separate fleets five or six thousand miles apart by sea is ridiculous. The two fleets are so separated, mail communication so slow, weather conditions so different in the two oceans, that real competition does not exist. Keenest competition is secured when a large force of vessels is assembled, all in sight and in touch with one another. Greater effort is necessary to win the pennant for engine efficiency, gunnery, or what-not in a fleet of one hundred ships than in one of fifty.

The strongest argument of all, the one which Admiral Mahan had in mind when he called the policy of division "suicidal" is that a divided fleet gives an enemy an opportunity to destroy the two fleets in detail. A Japanese fleet, by interposing, might catch one-half of the fleet at a disadvantage; similarly a European nation, by placing a fleet in the West Indies, might accomplish the same end.

The teaching of history, the warning of our greatest naval strategist and the present crying need for economy, unite in demanding that our fleet, no matter where it may be based, shall be reunited into one powerful unit.

Consider the score of economy. Many of our naval ships still burn coal, and there is no coal on the Pacific—it has to be taken there at a huge expense by colliers. Even as regards oil fuel, it should be remembered that while the cost is about the same on each coast, there is a greater supply on the Atlantic with more tanks and better facilities for handling it—hence, fewer tank vessels will be needed and much money saved. The argument on the score of general supplies is even stronger, for nearly all supplies are manufactured on the Atlantic side.

Labor, the greatest element of cost today, is very limited in the Pacific and is more expensive. The same thing is true of steel, all of which comes from the East. Of the greatest importance, too, is the question of personnel, most of which lives on this side of the continent. We have here a more fertile area for recruiting and the nation is put to very great expense in transporting the personnel to and from the Pacific when enlistments and changes have to be made. Finally, in the important question of morale, we must remember that sailormen are as human, perhaps a little more so than the rest of us. They all like to get home occasionally, and as the homes of the majority of the men are on the Atlantic side, it follows that if half the fleet is based upon the other coast there will be a falling off of enlistments and an inevitable discontent engendered.

Naval and Military

The Capsize of Eagle Boat No. 25.—The Eagle boats have never been popular either inside or outside of the Navy. We confess that to our eye they have always looked unstable, and this defect was emphasized during a severe thunder storm on June 11th, when Eagle Boat No. 25 capsized with a loss of nine of the crew. A heavy wind struck the boat during a severe electrical storm; but although she turned turtle, other craft in her vicinity came through the test in safety. The boat was two hundred feet in length, twenty-five feet six inches in beam, and had a displacement of about six hundred tons.

Our Future Army Strength.—The official figures for the strength of the Army of the Reorganization Act of 1920 show an authorized strength of 298,882 commanding officers, warrant officers and enlisted men, of which the Infantry will have 38.2 per cent; the Field Artillery, 13 per cent; the Coast Artillery, 10.5 per cent; the Cavalry, 7 per cent; the Air Service, 5.9 per cent; the Corps of Engineers, 4.2 per cent; and the Signal Corps, 1.8 per cent. The annual appropriations for 1914 for the Army was $94,266,145, which is slightly less than one-quarter of the Army appropriations for the fiscal year 1921.

Expenditure of Ammunition in Flanders.—The final report of Sir Douglas Haig includes some amazing figures of ammunition expenditure in Flanders. In the opening attack, in 1917, the total expenditure on July 31st exceeded 23,000 tons; and on the two days, September 20 and 21, 42,000 tons were expended. From the commencement of the British offensive in 1918 to the conclusion of the Armistice 700,000 tons of artillery ammunition were expended by the British Army on the Western front, while in the three days of crucial battle on the 27th, 28th and 29th of September, nearly 65,000 tons of ammunition were fired by their artillery.

The Latest Rigid Airship.—In the latest rigid airship, R-80, as developed by the Vickers people, particular attention was given to the elimination of unnecessary head resistance and the cutting down of weight, and the builders have produced in R-80 a ship of only 1,250,000 cubic feet capacity, whose performance in speed and endurance is equal to that of R-33 and R-34, which have a capacity of 2,000,000 cubic feet. The over-all length of R-80 is 530, its diameter is 70 feet, and its height, 85 feet. The total gross lift is 38.5 tons at sea level, and the disposable lift is 17.5 tons. At full power, the estimated speed is over 60 miles per hour, and the cruising radius at this speed is 4,000 miles, and 6,500 miles at fifty miles per hour.

The Object of Lofty Flying.—The Air Service has issued a statement explaining the object of Major Schroeder's recent flights at altitudes in which he made a world record. It says that there was long and careful planning and much experimental work was done before the flights were attempted. Future wars will be fought largely in the air, and, because of the development of anti-aircraft guns, much of the airplane work will be done at altitudes of 20,000 feet and over. For flight at these altitudes, the aviator must be provided with devices which will enable both him and his machine to function properly, and it is these facts which have caused the Air Service Division of the military service to carry on this highly scientific and very successful work.

The Seventy-Five Mile Gun.—We stated, in our issue of April 27, 1918, that the Germans were probably using one of their 15-inch naval guns with a subcaliber tube inserted to obtain the necessary length for the great range of seventy-five miles. It now appears that they did use several worn-out, 45-caliber, 15-inch naval guns. They screwed on to the muzzle of this great gun an additional outer tube forty-five feet in length, and then inserted a tube one hundred feet in length, which was bored and rifled to a bore of 8.2 inches. To the gun as thus assembled they added a smooth-bored twenty-foot section, the total length being 120 feet. This great length was adopted in order to keep down the powder pressure and the erosion. The guns, because of the inequalities in the powder were erratic, and it is believed that after fifty rounds they became so worn out as to be unusable.

Science

Making Streets Safe for School Children.—A commendable campaign among school children is being conducted by the Safety Bureau of the Philadelphia Rapid Transit Company. More than 185,000 school children in that city have listened to stories and talks on "Safety First," and three-quarters of a million pieces of illustrated printed matter on the same subject have been distributed in the schools. A striking feature of this campaign is an organization of 300 boys who daily patrol crossings in the dangerously located school neighborhoods.

A Naturalist in an Airplane.—Dr. Chalmers Mitchell, who took part in the recent attempt to fly from Cairo to the Cape, has sent to the *Times* (London) a detailed account of his observations, which serves to illustrate how much valuable work in physical geography and kindred subjects may be carried out by a suitably qualified airman. His bird's-eye view of the Nile basin is a notable contribution to our knowledge of the physiography of that region and of the geological processes which have occurred there. He also furnishes interesting information concerning the larger animals observed along his route.

More Light on Botulinus Poisoning.—According to the U. S. Bureau of Chemistry the recent sensational cases of poisoning from ripe olives have occurred almost exclusively in connection with olives put up in glass. A plausible explanation is offered by the Bureau. It appears that the trouble is due to defects in the methods of pickling, packing and processing the olives. In most establishments the product when packed in glass is sterilized at about the temperature of boiling water, and this temperature is too low to ensure the destruction in every instance of the *Bacillus botulinus* and the toxin it produces. The trouble, the Bureau says, is not inherent in the glass container, if sound olives be used and the packages are properly sealed and sterilized. Unfortunately some of the packers in their anxiety not to break the glass containers do not always process the olives at a sufficiently high temperature. The poison would develop just the same in tin under the same circumstances, but as there is no danger of breakage in tin there is usually no hesitation on the part of the packer to apply sufficient heat. The Bureau is urging producers and dealers to make a thorough inspection of all ripe olives in glass and to destroy any that show the slightest sign of decomposition. It is also recommended that all olives, whether in tin or glass, which may have been processed at too low a temperature be sent back to the packers for reprocessing.

International Meteorological Conference.—The report of the International Meteorological Conference which met in Paris last October, at the invitation of the French Government, has just been published. In view of the far-reaching changes that have recently taken place in the scope and methods of meteorological work—due especially to the new requirements of commercial aeronautics—this meeting was timely, and most of the national weather services of the world were represented by delegates. The General Powers were not invited to participate; and the United States of America, which possesses the most imposing meteorological bureau in the world, was not represented, because Congress failed to make the modest appropriation recommended by the President to provide for the expenses of two delegates. The conference decided to perpetuate, with some slight modifications, the international organization of meteorology that existed before the war. Sir Napier Shaw remains president of the International Committee. Much important work was accomplished by the conference, looking to a material enlargement in the scope of weather reports and their dissemination, especially by wireless, for the benefit of aeronauts. In lieu of the old commission which bore the misleading name of International Commission on Scientific Aeronautics there were organized two new commissions; one on the applications of meteorology to aerial navigation, and one on the exploration of the upper atmosphere. There are also international commissions on agricultural meteorology, weather telegraphy, marine meteorology, solar radiation, the *Réseau mondial*, terrestrial magnetism and atmospheric electricity, and polar investigations.

Automobile

Keep Clips Tight.—Spring clips should be inspected at least once a week and tightened as much as possible. If the clips become loose, the spring will break between the clips. If there is undue stretching of the clips, the difficulty might be overcome by having new clips made of better material, as it is always cheaper to replace clips which are too light than to have broken springs as a result. The bearing place upon which the spring rests on the axle should absolutely conform to the curvature of the spring at that point, as sufficient bearing surface is just as important as tight spring clips.

Why Horses Are Retained on Farms.—When discussing the motorization of the farm, agriculturists are always ready to state that even though most of the work of the farm will be done in the future by motor devices, the horses will still be found necessary. Attention has been called to the fact that street car railroads were electrified and for a long time maintained large stables of horses. Electric roads have no horses today. Big business in the large cities motorized and for long periods continued to maintain stables of horses because of some lack of confidence in the motor equipment to meet an emergency that never came. Big business interests are now gradually giving up their horses. Farmers will motorize and continue to keep their horses until such time as their confidence is thoroughly established in the motor equipment of the farm motor truck, tractor, etc., when they will quickly give up the horses.

Automotive Industry Magnitude.—That 1920 will be the greatest producing year thus far in the history of the automotive industry can be readily foreseen, with the great demand for motor vehicles in this and other countries. Production in America has reached such a point that the National Automobile Chamber of Commerce announces that this year's business will rank second only to steel. The 1919 production totaled $1,807,594,580 and if bodies and accessories were included, this figure would exceed $2,000,000,000. Exports of automobiles and parts, including tires and engines, for the government's fiscal year ending June 30, 1919, surpassed all previous records by aggregating $185,000,000. The former high record was in 1916, when $140,000,000 business was done with foreign nations. Of the total amount of 1919 exports, $35,000,000 worth was commercial cars, $75,000,000 worth was passenger cars, $41,000,000 parts of automobiles and nearly $30,000,000 worth was tires, while about $5,000,000 worth was automobile engines.

Taking Down the Motor.—In order to look over the parts of an engine and to restore the worn or defective components it is necessary to take the engine entirely apart as it is only when the power plant is thoroughly dismantled that the parts can be inspected or measured to determine defects or wear. If one is not familiar with the engine to be inspected, even though the work is done by a repairman of experience, it will be found of value to take certain precautions when dismantling the engine in order to insure that all parts will be replaced in the same position they occupied before removal. There are a number of ways of identifying the parts, one of the simplest and surest being to mark them with steel numbers or letters or with a series of center punch marks in order to retain the proper relation when reassembling. This is of special importance in connection with dismantling multiple cylinder engines as it is vital that pistons, piston rings, connecting rods, valves, and other cylinder parts be always replaced in the same cylinder from which they were removed, because it is uncommon to find equal depreciation in all cylinders. Some repairmen use small shipping tags to identify the pieces. This can be criticised because the tags may become detached and lost and the identity of the piece mistaken. All parts should be thoroughly cleaned with gasoline or in the potash kettle as removed, and wiped clean and dry. This is necessary to show wear which will be evidenced by easily identified indications in cases where the machine has been used for a time, but in others, the deterioration can only be detected by delicate measuring instruments.

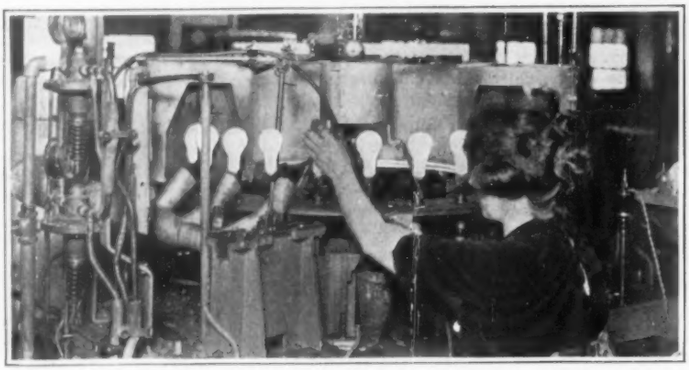
A Chemical Loafer, and How It Was Put to Work

Argon, the Laziest of All the Elements, Plays a Big Rôle in the Latest Incandescent Lamps

By E. W. Davidson

ONE of the most useless of the constituent elements of the air we breathe was turned to a highly valuable use for mankind when argon gas was first injected into incandescent lamp bulbs. By filling lamps with this gas, which is among the laziest of all gases, and by observing certain precautions, the efficiency of the lamp thus made was greatly increased. Furthermore, argon gas has helped the larger sizes of incandescents up to the huge 1,500 watt lamp to displace arc lamps for street lighting purposes.

Sir William Ramsey first discovered argon in 1894 which he found to constitute about one per cent of the atmosphere. By this discovery he filled out one of the blanks in the chemical periodic system. Previously it had been noted that nitrogen extracted from the atmosphere was heavier than nitrogen produced by chemical process. The search for an explanation of this led to the discovery of argon. But he found absolutely no practical use for the new gas. For 20 years this valuable element was permitted to continue in its happy state of desuetude.



The air is exhausted from the lamps when the turn-table carries them through the oven. They come out at the left, are cooled by air-blast, and as they come to the position beneath the operator's left hand the argon is injected from below.

Filling lamp bulbs with the purified argon

Nobody used argon until Dr. Irving Langmuir in the Research Laboratory of the General Electric Company at Schenectady discovered the increased efficiency to be gained in incandescent lamps by filling them with inert gas instead of merely making them vacuous. He used both nitrogen and argon.

Nitrogen was promptly put to use in lamps because it is comparatively easy to extract so prevalent an element from air, but nobody used any argon on a large scale until about 1914 when an air products company constructed machinery, which by fractional distillation from liquid air, produced it in considerable quantities mixed in equal parts with oxygen and nitrogen. This is the form in which it is marketed today. At lamp factories the oxygen is thoroughly removed by passing the mixed gases through a tubular furnace nearly filled with copper filings at red heat and about 90 per cent of the nitrogen is extracted in another furnace. Then the argon, about 90 per cent pure, is injected into lamp bulbs.

The very inertness which once stamped argon as absolutely useless has proved to be its valuable quality. The facts that it is relatively stubborn in its refusal to serve as a conductor of heat and that its density discourages the evaporation of tungsten filaments even at tremendous heat have therefore made it possible to increase the temperature of lamp filaments with a consequent increase in lamp efficiency beyond the point which was the previous maximum. So a greater candlepower is possible without undue deterioration of the filament; or keeping candlepower fixed, the life of the bulb is prolonged.

Although it has not been economically advantageous to use argon in the lowest current lamps, its use renders the higher current lamps more brilliant and efficient. Large argon-filled lamps equal in efficiency the magnetite arc, so as to serve for any sort of street lighting except to produce the brilliant glare needed for "white ways." Argon-filled incandescents, which can be mounted in varying sizes on a single circuit to meet varying needs as arcs cannot be, and whose glow never flickers as does the glare of arcs, have established their supremacy for general outdoor lighting as well as for other medium and high-power illumination needs.

Rail and Street Car Indicator

THE London Metropolitan Railroad has arranged to put into operation on its system an electrical device whereby the names of stations are indicated in the passenger cars. The system is operated by illuminating sections of the ceilings of each compartment, arranged in panels, each of which in turn becomes prominently lighted up as the journey proceeds. At the commencement of the journey the next station becomes so indicated: when that point has been left, the section or panel applying to it becomes dull, but the next becomes illuminated. Before starting a journey the motorman actuates a series of switches, and the rest of the action is automatic, the mechanism being operated by a small striker on the track between the stations. In addition to the names of the stations, it is intended to show a map of a square mile of streets around each spot, giving shopping centers and amusement places.

This indicator is to be put into operation on the Great Northern tube.

The concern controling the device claims that as passengers will thus easily become acquainted with their whereabouts, time should be saved and congestion relieved.

1. The calcium carbide furnaces in which the argon is purified of nitrogen at a temperature of 900° Centigrade, and brought up to 80 per cent pure. 2. The first step; the commercial argon received in the cylinders is burned in a hydrogen flame to free it of 30 per cent of oxygen, after which it goes to the furnaces shown in the first photograph. 3. The finally purified argon is pumped through big meters and into the cylinders, from which it is fed into the lamps.

Removing oxygen and nitrogen from commercial argon to make it fit for use in filling incandescent lamp bulbs

Left: Hauling the drag full of excavated material up to the dumping position. *Center:* A general view of the outfit. *Right:* Caught in the act of dumping

The drag-line excavator-loader that delivers the material to the truck in the very bucket that digs it

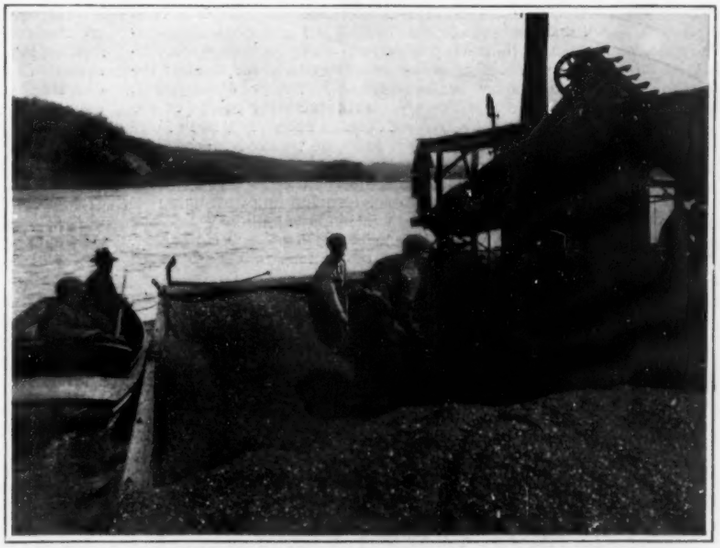
Digging and Loading in One Motion

By B. F. Mundorff

A NEW excavator-loader is especially designed for excavating work, for the removal of materials from one location to another and for general work where flexibility of operation is not limited so closely as in the case of the steam shovel. It likewise eliminates the pickax and shovel worker entirely.

The machine is in reality a portable dragline, filling the gap between the steam shovel and the antiquated and expensive gang of hand shovelers. Because of the principle on which it operates, portability is a feature "built in" this excavator and loader. Only two men are necessary to the operation of the machine; one at the operating levers and one at the loading point. To a point anywhere within 50 to 200 feet from the machine is stretched a chain, at right angles to the line of digging; upon this chain are two sheaves hooked to the chain. Either sheave may be unhooked and relocated in an instant. One heavy cable passes from the hoist drum on the machine, then to the digging skip, then through both sheaves, back to the retrieving hoist drum on the machine.

The operator of the machine manipulates but two levers and a foot brake. As he places power on the digging line the other man manipulates the handles on the skip, so as to fill it with the material to be dug or removed. The skip has a capacity of 15 cubic feet per trip. As soon as the skip is filled the man releases the handles and allows the skip to ride to the excavator. As the skip strikes the apron at the machine it unlocks the catch arm then carries the skip up over the machine and on to a slanting chute located on the front of the machine from where the material in the skip discharges into the waiting wagon, truck or railroad car. The skip is then quickly retrieved to the starting point and the operation repeated.

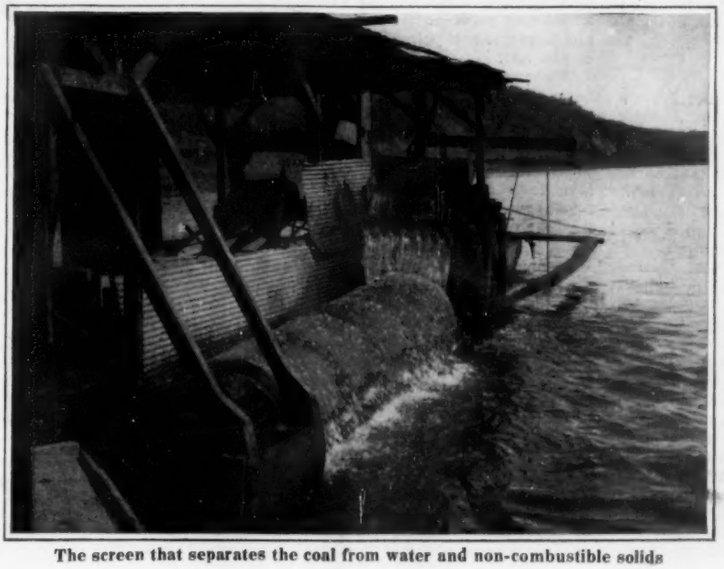


Shoveling the coal on the barge for delivery ashore

Pedigreed Chicks from Incubators

WHEN eggs are hatched in incubators, the difficulties incidental to pedigree work are such that many poultrykeepers do not attempt it, simply using eggs from selected hens and letting it go at that. Others hatch special pedigree eggs under hens. Mosquito netting bags for incubators, into which the marked eggs are placed on the 18th day of incubation, each sack being indexed, are successful, but somehow do not "catch on" with poultry breeders. The new cornpopper plan will be much more popular with the average breeder. It is so simple that any poultrykeeper can use it.

Two-quart wire cornpopper baskets, the common kind purchasable at any hardware or general store, are used, one basket for the eggs of a particular hen. Attached to the basket is a tag on which the hen's number is entered. During the hatching time, in this manner, the chicks of one hen, or the chicks of several, may be kept separate. Whether the pedigree work is simple or elaborate, the cornpopper plan is efficient. The breeder must bear in mind that when cornpopper wire baskets are used chicks have less room to hatch in than when the whole floor of the incubator is free to them. If the hatching percentage is heavy, and many of the eggs are pedigreed, there can easily be overcrowding. For this reason the poultry keeper should watch the operation, and if an emergency arises be prepared to transfer some of the eggs for hatching to a second incubator, so that there will be room for all. The object can be attained by loading incubators under capacity.—By *J. T. Bartlett.*



The screen that separates the coal from water and non-combustible solids

Mining Coal with a Dredge

By George Gaulois

IN many parts of the anthracite and bituminous fields of the East there are to be found locations where the mad rush of previous generations to skim the cream from Nature's offerings, regardless of what happened to the skimmilk, has resulted in leaving in the river bottoms large accumulations of coal which the miners of a generation ago felt that they could not afford to transport to market in the presence of better grades and more convenient sizes. Today, in the search for economies, we are beginning to bring this coal to the surface and avail ourselves of it. In addition, there are a few places where there appear to be deposits of coal in their original positions at the bottoms of water courses, and these frequently can be mined by the same methods utilized to get at the submarine dump-heaps of former days.

Sometimes the work is done from shore, sometimes from barges moored out in the stream. We illustrate herewith a process of dredging, followed by screening of the material brought up from the river bottom, which is resulting in the recovery of a lot of good coal from the Susquehanna River, near Danville, Pa. The coal here is of fair size and good quality, and comes from the water in the shape of smooth rounded lumps. There is of course a good deal of non-combustible solid matter with the coal, but this can be said of mine coal, and its removal from damp, dustless river coal is if anything more easily effected than in the case of coal brought up from below ground. One of our illustrations shows the apparatus with the aid of which this is accomplished and the coal separated from the water at the same time, while the other gives ocular evidence that this scheme for coal recovery is on a very respectable scale.

A New Form of Vibration Galvanometer

VIBRATION galvanometers are very useful in zero measurements, but have not been much used in industrial laboratories on account of their being sensitive to external vibrations and requiring delicate adjustments. A new instrument developed by the United States Bureau of Standards, which has a sensitivity higher than other forms of the moving-iron type, but less than that of the most sensitive forms of the moving-coil type, has the advantages of sturdiness, quick responsiveness, and freedom from the effects of external vibration. It consists essentially of a fine steel wire mounted on one pole of a permanent magnet, and so arranged that the free end of the wire may vibrate between the poles of an electromagnet through which the current to be detected passes. The paper describing this instrument, Scientific Paper No. 370 of the Bureau of Standards, is now ready for distribution and any one interested may obtain a copy by addressing a request to the Bureau.

Turning the Wheels of a Century Hence—III

What the United States Must Do to Forestall the Day When Fuel Goes Beyond the Common Reach

By C. H. Claudy

THE first reason, of course, why we have not developed every bit of our available water power, is the economic factor that all water power is not sufficiently near a market to make its development commercially possible. That is a condition which time will remedy as the demand becomes more acute; a market will be created by industries willing to move to or near the power site. Second is the fact that water is an asset of the nation, not of individuals, and that in a laudable endeavor to conserve the nation's asset for the nation, the nation's legislators have often gone too far and put such heavy restrictions upon the construction of water powers as to scare away capital and make it afraid to invest. Such a restriction is found in the requirement that a Federal license be revokable by the power of one man. No one man, no matter how wise, has vision enough adequately to consider all points in so complicated a question as this, and capital rightly believes that it should not risk its life against the decision of a single individual.

Third in the limiting factors is the conflict of interests between the power makers, the power users and the users of water as a means of transportation. No navigable river should be closed to navigation by the construction of a power dam. So much is self-evident. But navigation interests go farther than that, and frequently object strenuously to a power dam, even if provided with adequate locks by which navigation can be kept open. Also the question as to what constitutes a navigable stream is one not to be decided offhand. Some streams float logs which float nothing else, yet logs are important to industry. Canoes and ocean liners alike bear freight, yet who is to be wise enough to state at what point the draught of a vessel decides the navagability of a stream?

The Sherman Act may act as a limitation upon power developments, for a very odd reason. To make this plain it will be necessary to say a word of the practice of "coupling" power stations, which may perhaps best be done by quoting from a government report on the subject. It is stated that it may occur, that of two power sites tributary to a given market, neither will meet the demand, whereas if both are used together they will. If, for example, there is a market for 5,000-horse-power and there are two accessible power sites, one capable of supplying 4,000 continuous horse-power and the other 1,000 horse-power, it is obvious that neither alone can meet this demand; but if the two should be "coupled" together the demand can be met. This may be called making the smaller site auxiliary to the larger. It is true that the power from both sites can reach the market and can, therefore, supply it even though they are not coupled. There would, however, be the expense of separate transmission and distributing equipment and separate management, and this expense might be such as to prevent the development of the smaller power.

One Plus One Not Always Two

Again assume two sites, one capable of meeting the demand during the hours of minimum requirements and the other large enough to meet the maximum demand extending over, say, 10 hours. If the larger plant is kept in operation constantly, its pondage will be so reduced that within 24 hours or, at the longest, in a few days, it will not have sufficient power to meet all the demand. The smaller site can at no time meet the maximum demand. In this case neither site can separately supply the market all the time, but coupled together they can. Thus, if one site alone is able to meet the lowest demand and during this time the other plant can remain idle and accumulate water, this accumulation will contribute to meet the larger demand during the busiest period of each succeeding day. The principle is equally applicable whether the sites are on the same or on different streams, provided such sites are accessible to a common market.

It may not at first sight be plain why there is so great a saving as engineers tell us is actually made, when the coupling together not of two but of many plants is accomplished. But remembering that an isolated plant must be capable of supplying its maximum demand, which capacity is not used to the limit for more than two-thirds of the time, consider the testimony of Mr. C. C. Merrill of the Forest Service before the Committee on Water Power of the House of Representatives last year. Said Mr. Merrill: "The larger the power market served, the greater is the diversity of use, the more regular and continuous the demand, the higher the load factor, and the smaller the percentage of surplus equipment required. Eighty per cent of the electric power development of the State of Montana is in one single power system. The capacity-load factor for that state in 1912 was 58 per cent as compared with 26 per cent for the United States as a whole. Studies made in 1912 for the cities of New York and Chicago showed that the consolidation of the operating stations in the latter city would have saved from $10,000,000 to $12,000,000 in investment. Similar consolidation in the city of New York would have saved from $18,000,000 to $20,000,000 and would have reduced operating expenses by $1,000,000 a year.

A Big Game for Big Players

"Had our railroad systems consisted of short, independent, competitive lines, each interested in serving its particular local territory, they would have been utterly helpless in the face of the transportation situation of the war-time period. Even as they were, further unification became necessary in order to meet the extraordinary traffic demands. Power development, particularly in the great manufacturing states of the East, where the greatest demand exists, is still in large degree in the primitive state of isolated independent development. Were these stations interconnected to the full extent which is now thoroughly practicable, hundreds of millions of additional kilowatt-hours of electric energy could be made available without the addition of a single dollar's worth of new equipment.

"While interconnection of stations is a measure of economy in steam-power development, it is a measure of necessity in any general water-power development, particularly in the eastern United States. No considerable development of eastern water power will come about except through interconnection of plants over wide territories in order that the diversity of demand in different markets and the variation in water supply at different sites may raise the load factor of the combined system to a point where steam-power competition can be met.

"On account of the extent of the territory which will be involved and of the fact that the power transmission systems must ignore State lines no authority less than that of the Federal Government will have sufficient jurisdiction either to conduct the investigations or to exercise control over the completed system. There is a transmission system already operating in California, the termini of which are as far apart as Washington is from Eastport, Me., or from Jacksonville, Fla. The future of water-power development in the East must be along similar lines."

Here is where anti-trust legislation is a handicap. Our nation after rioting in competition, passed to a great centralization of industry, only to become frightened at the power of even "good" corporations. Came the Sherman Act, and as we all know, the Standard Oil "trust" was "dissolved" and the packers are being made legally to behave and the steel industry escaped dissolution by the skin of its teeth and so on. Capital is afraid of an industry where combination is salvation, and independence, suicide. We must have vast power systems, linked together physically, in order that the fluctuations of demand on the one side and water flow on the other can be met. It is not feasible to interconnect dozens, perhaps hundreds, of power sites physically and not have that connection extend to some degree in the business relations. Legislators have done wisely, perhaps, to limit combinations of factories and businesses to the thwarting of competition. But that same limitation applied to water power may strangle not only the combination but the power.

Where Congress Comes In

There have been very few developments of water powers in the last few years, largely because the country has been waiting upon Congress to pass a new water-power act which would clarify the situation and remove the difficulties from the path of development. A bill has been passed in House and Senate and is now in conference, from which it will emerge some time, possibly at this session, in what form no man knoweth. The bill is a weighty document, and considers so many features of water-power development that it cannot even be summarized here, but it does license water-power development for a period not exceeding fifty years and does provide that such license once granted cannot be revoked by any one man's authority.

The provision for control through the possibility of loss of license is simple and direct. It says: "That the Attorney General may, on request of the commission or the Secretary of War, institute proceedings in equity in the district court of the United States in the district in which any project or part thereof is situated for the purpose of revoking for violation of its terms any permit or license issued hereunder, or for the purpose of remedying or correcting by injunction, mandamus, or other process any act of commission or omission in violation of the provisions of this Act or of any lawful regulation or order promulgated hereunder. The district courts shall have jurisdiction over all the above-mentioned proceedings and shall have power to issue and execute all necessary processes and to make and enforce all writs, orders and decrees to compel compliance with the lawful orders and regulations of the commission and the Secretary of War, and to compel the performance of any condition imposed under the provisions of this Act."

The general public, of course, has little knowledge and less interest in questions of this kind, merely because they have not reached an acute stage. But power is to be the future warmth of this nation, and there are some resources which will never be developed without power, cheap power and plenty of it. We know how to make our own nitrates, yet Chili continues to be our nitrate bank. The air is free to all—the nitrogen we need for fertilizer and for munitions is four-fifths of it. It can be extracted and made useful. Give us enough cheap power and Chili can exhaust her nitrate beds for all we care.

Power and Transportation

Transportation is the life blood of a nation. Our history has been a history of railroad development, now being paralleled by the construction of good roads and the infinite multiplication of self-moving units—trucks and automobiles. But the days of gasoline, at least at present or lower prices, are numbered. Some substitute must be found. Synthetic fuel can be made but the manufacture takes power. Shall we burn coal or oil to make another fuel to burn? Or shall we utilize gravity to drive our motor trucks *via* electric power made at the falls and converted in one way or another to the synthetic fuel which represents for us our only practical way of storing power?

If the United States is to continue in the future what it is now, as the leading manufacturing nation, and if it is to make full use of the greatest number and diversity of natural resources which an all-wise Providence ever provided for any country, it must use power in large quantities. That power nature has given us. The rivers are here. There are vast numbers of natural falls. Artificial falls but await the magic touch of the imagination and the engineer to come into being. Reclamation projects with their huge dams already use the water first for power, next for irrigation. Are we to neglect this, our greatest natural resource, because of economic specters, legislative ghosts, intangibilities like state lines, statutes like the Sherman law, enacted with no such idea in mind?

Here are we, owners in fee simple of millions of

(Continued on page 72)

WHEN we have followed Mr. Claudy while he makes it plain that in the development of water power lies the only direction in which we may hope for relief from the prehistoric necessity of burning fuel when we seek heat or power; and when we have pursued his discussion of what constitutes water power and what does not—why, then, the natural question is, "Why have we not developed every bit of our available water power?" The answer to this question and to its natural companion, "What are we going to do about it?" form the theme of the present and last article in the series.—THE EDITOR.

Fighting Waves with Compressed Air

An Artificial Reef of Air That Breaks Up the Rollers and Makes Them Harmless

By George F. Paul

THE use of compressed air to prevent piers from being demolished and shores destroyed by the merciless pounding of the breakers is a modern method that is proving successful in actual service. It took men a long time to figure out this simple yet effective means of making the mightiest waves as harmless as the ripples kicked up by a good stout fish. The compressed air fights its way to the surface of the water with a combined rising and explosive action. This breaks up the wave motion. The wave is simply confused—it cannot go ahead. It hesitates, curls over, breaks on the rising wall of air and water and then subsides with all its immense energy spent. Back of that point the water is protected, so that the shore is safe and vessels can ride undisturbed at anchor.

That the sea waves have the power to do tremendous damage is shown by repeated tests along various coasts, special instruments being used. The British Isles are among the greatest sufferers from the incessant pounding of the waves. Tests made along the North Sea coast showed a striking force of from three to four tons to the square foot. During a storm at Wick, huge blocks of concrete averaging 1,350 tons and 2,500 tons respectively were displaced.

Builders of sea-walls along the coasts of the United States have found that they had a powerful foe to deal with, and one that all too often got the better of the expensive defenses that they constructed. For instance, the actual value of property destroyed in the single town of Seabright, New Jersey, was enormous, and the sufferings inflicted on its citizens cannot be estimated. It would be hard to estimate the depreciation in property values along that part of the coast line, a depreciation shared by the lands not actually eroded, because of the apparent magnitude of the danger to which they are subjected.

It is because of these conditions that work has been undertaken to perfect compressed air apparatus that would successfully fight off these repeated encroachments of the sea. These experiments have proved very costly because of the large scale on which the work had to be done.

Now it has of course been long known that waves would break on a reef when they are of any magnitude and are in water of considerable depth. This is due to the interference with the continuity of the lower section of the wave action because of this sudden inequality in the floor of the ocean. Taking advantage of this fact, builders in Holland and England have constructed artificial reefs or wave breakers of random stone, with the idea of causing the wave to break on this and thus exhaust its force. Although this plan is efficient on some coasts, yet there are several objections to it. One of these objections lies in the fact that the stone reef interferes only with the lower layer of wave-action.

Theoretically it is a very simple thing to talk of the formation of an artificial reef at any point by using compressed air expelled from a perforated pipe lying on the bottom to form such a reef. There were, however, a number of practical considerations that had to be tested and worked out before such an idea could become commercially valuable. Some of the questions that came up immediately were these:

What would be the necessary amount of air required per foot of perforated pipe used to produce calm water?

How could this air be equally distributed?

How could this perforated pipe be prevented from filling with sand?

Obviously, the only way to answer such questions as these was to install such plants and watch the operation. The first tests were made on a muddy bottom in New York harbor at a depth of 30 to 40 feet to determine the most efficient size for the perforations in the pipe and their distance apart. A second trial was made at the end of one of the costly piers at Atlantic City, on a sandy bottom at a depth of 21 feet. The next test was made on "the stern and rock-bound coast" of New England, off Crotch Island, Maine. On the day of the trial, waves were rolling so high that the spray was flying over the tops of the trees along the shore. Fifteen minutes after the air was turned on, it was possible to paddle around in a canoe in the smooth water that the air breakwater furnished.

The U. S. S. "Yankee" managed to get ashore on Hen and Chicken reef in a very exposed position off the Massachusetts coast. Before the air was turned on, the seas were boarding the ship fore and aft, causing it to grind very much on the rocky bed and making it very difficult for the wrecking crew to do any work. After the air was turned on in the breakwater, it was as if the ship lay in a lagoon formed by the air breakwater.

The latest plant to be established was one in front of an expensive pier at El Segundo, California. This pier, which was originally 4,000 feet long, and has cost hundreds of thousands of dollars to build and maintain, had nearly 2,000 feet washed away in recent severe winter storms. To save the remainder of the pier it was decided to try the compressed air method. The plant consisted of three sections of perforated pipe, the first section of 120 feet being out in front of and at a distance of 145 feet from the pier head. The two other sections were 100 feet each and lay at right angles to the pier, one on each side, starting right from the pier head. Not only have these pipes kept the pier from being swept away, but they have also broken up the ground swell which so often interferes with the loading of vessels at piers along the Pacific coast. The swing of the boats alongside the piers has often been so strong that 14-inch manila lines have been known to be snapped like pack threads.

The Pacific coast is especially in need of some means for treating artificial harbors. There is not so much coastwise shipping as there undoubtedly would be if

(Continued on page 72)

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

The High Cost of Milk

To the Editor of the SCIENTIFIC AMERICAN:

This household has been a subscriber of yours directly or indirectly through a local news agency for the past forty years. We have always found it a source of satisfaction to know that we possessed dependable information about our navy, the various great engineering undertakings, our coal or oil resources, besides greatly diversified mechanical information which is becoming so fundamentally necessary to a farmer living in these mechanical times.

I am merely a farmer, laboring long hours on a farm of some 350 acres. I have little time to read, but I keep in touch with the features of each issue as they appear.

In your issue of November 22, last, I was particularly interested in the article on "The High Price of Milk" by Alfred J. Lotka. Mr. Lotka's opinion is correct so far as it goes. The farmer can produce more milk and produce it cheaper by knowing his cows individually and by conducting his dairy operations scientifically as suggested; but if I were to write an article on "The High Price of Milk" I should not omit the most important part—the cost of distribution. Do you know that it costs more to distribute milk in New York City than it does to produce that milk and deliver it to New York? Do you know that farmers are actually penalized during nine or more months of each year for producing too much milk? In most cases the farmer has to part with this surplus milk at a considerable loss.

The farmer has not received the cost of production for milk, which has caused him to diversify his farming as much as possible. But now it appears that the labor situation may force the farmer to work on the basis of an eight-hour day or pay excessively higher wages for a longer day.

Within the past three years in this fertile Mohawk Valley I have seen the families on ten farms in this immediate community comprising 1,400 acres auction off their goods and move to the cities. On some of these farms it is now common to see large fields of 30 or 40 acres stand in weeds. These people had become tired of 12 to 16 hours a day of drudging, Sunday as well as Saturday afternoon, for less pay than they could receive in the cities for eight hours' work without any equipment. The whole trouble lies in your extravagant delivery system in the city. You have hundreds of wagons with their drivers that do nothing but deliver milk to the retail buyer for a few hours each morning. You have huge depots where these wagons load and to which they return and in which nothing but milk is handled. You have a vast organization that does nothing but buy milk from the farmer and deliver milk to the user and manufacture milk products out of the residue that remains undelivered.

How much do you think you would pay for your morning paper if the young fellow who leaves it at your door did nothing but deliver papers over his morning route? if instead of utilizing subway and every other existing facility the jobbers in this field delivered all orders to the retailers in their own trucks, used for nothing else? if instead of the regular news company that deals in weekly and monthly magazines and maintains stands that sell candies, tobacco, etc., etc., you got your morning edition through a news company with an equally ambitious organization, but dealing only in morning papers? Of course milk is a food, and a mighty important one, and of course the problems of producing and marketing it are complex ones. But with the example of the great packers before us, can we maintain that on this account the production and sale of milk ought to be asked to maintain such a large and exclusive establishment? I do not suppose, if you raked the city with a fine-tooth comb, you could find another industry in which the overhead expense and the invested capital bear so high a ratio to the wholesale cost of the product dealt in.

By all means let those who feel that their milk must come to them *via* a personally conducted tour in a private coach under the conduct of a special footman have their milk brought to them that way. But why should all consumers be asked to patronize this system? If it were not a sufficiently vicious one on the grounds I have already covered, it would be branded as intolerable by the domination which a reckless labor organization of drivers has attained over it. Think of it—fifty, sixty dollars a week for a service which in a simpler community did not exist. Why should milk be thus coddled, above all other foods? You buy meats and other perishable items that have to be put on ice, and you don't insist that they come to you ten minutes before you are ready to use them. A rational system of distribution through existing retail stores that dispense other foods—that is the real answer to cheaper milk. And until some such measure is adopted for freeing milk of the excessive overhead which it has to carry, and from the ruthless greed of an organization of the most unskilled labor that I can imagine, there will be little relief for the farmer or for the consumer.

We, as farmers, can live and maintain our health with conditions as they are, but Dr. Copeland, your health commissioner, will tell you that many children in your city will later become tubercular because they have suffered malnutrition due to a lack of milk during their growing years.

I trust you will appreciate the importance of this matter and will lend your good offices toward helping to correct this abominable situation.

Amsterdam, N. Y. D. BOYD DEVENDORF.

The Airplane Cloud

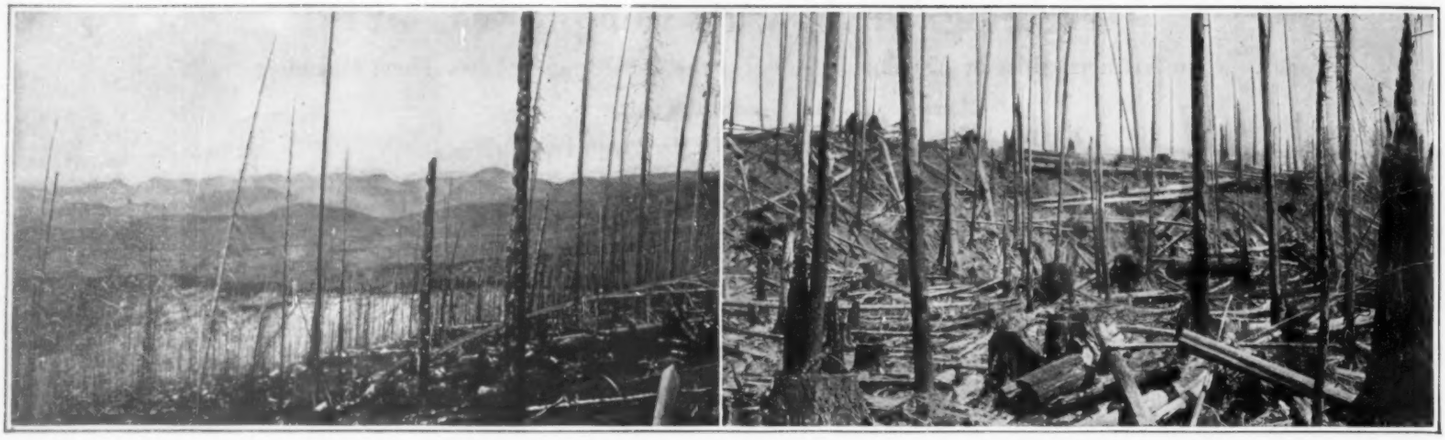
To the Editor of the SCIENTIFIC AMERICAN:

On page 357 of the April 3rd issue of the SCIENTIFIC AMERICAN appears a paragraph under the heading "Cloud Formation in Wakes of Airplanes."

Although I have never heard the phenomenon described as it is in this paragraph, I have often observed it. Quite naturally, I always supposed it was an attenuated stream of smoke—rather than a cloud—visible only because of exceptionally clear atmosphere.

In July, 1918, I saw this cloud in the wake of an airplane flying about four miles high, over the Front at Albert, France. Then, during the last week in September and the first week in October, 1918, I saw the same thing several times near Verdun, France. In every case the cloud appeared exactly as it is described in the SCIENTIFIC AMERICAN although the lengths I observed were not as long as those mentioned, I estimated the lengths to be about five to ten miles.

Chicago, Ill. R. V. WILLIAMS.



Left: Conditions in the Frying Pan watershed, in Colorado's National Forest. Burned area in foreground. *Right:* Debris left after logging of redwoods in California, with dead Douglas spruce killed by the fires set to clear up the redwood slash

Fair samples of what we are doing to our valuable timber lands

What About Our Forests?

How Long Shall We Be Able to Cut Them Down Four Times as Fast as They Grow?

By H. A. Mount

THE situation in which the paper industry finds itself because of a growing shortage of pulp wood is indeed alarming. But this is only one aspect of the far-reaching problem of our dwindling forests. Few of us realize the extent of our dependence upon the forests for prosperity. The census bureau estimates that of 276,000 manufacturing concerns listed, 52,000 of them depend wholly or in part on a continued lumber supply for continued operation. These represent an investment of $3,000,000,000 and employ 1,130,000 men—one-sixth of all the workers in the United States. And the raw material which occupies such a place in our economy we are consuming four times as fast as Nature can replace it.—THE EDITOR.

WE are using up our forests three times faster than they are growing and experts predict that in less than half a century our supply of saw-log lumber will be gone. White pine in the Lake states is nearing exhaustion and these states are now paying $6,000,000 a year in freight bills to import lumber. New England, self-supporting in lumber twenty years ago, now has to import one-third of the amount used. Half of the fir or balsam in eastern United States, which forms an important part of the timber supply there, is at this moment either dead or dying because of neglect. We provide insufficient protection against fires for our remaining forests and every year $20,000,000 worth of timber is destroyed in this way. The area burned each year is three times as large as the devastated sections of France and not only is the standing timber destroyed, but reproduction upon thousands of acres is killed.

These are just a few of the pertinent facts that are bringing about an awakening to the situation. The American Forestry Association of Washington, D. C., of which Charles Lathrop Pack is president, has actively begun a campaign in the Capitol for legislation providing a national forest policy, under which forests can be adequately protected from fire, conservative cutting can be practised, reforestation accomplished, and devastation stopped. They have been aided in their campaign by the daily press of the country, which has had the situation thrust upon it in a forceful way by an acute shortage of wood for making paper pulp. The newspapers, therefore, have been willing spreaders of needed propaganda.

But the destruction of our forests extends its results even further than the hampering of industry. It affects weather conditions, experts tell us. The increase in numbers of storms and tornadoes in recent years has been blamed, to some extent, at least, on the lack of trees. Forests regulate the flow of streams and the cutting of forests at the headwaters of navigable streams is sure to cause disastrous floods at one season and low water at another.

The Ohio River is a good example. Cutting of the forests in West Virginia has greatly affected the flow of the river. Every spring thousands of dollars worth of property and many lives are destroyed at Pittsburgh and Cincinnati, and at scores of other towns and cities along its banks, while in midsummer the river sometimes is so low that navigation is hampered.

In the face of these facts, it is hard to understand why we have so long neglected our forests. It is due, in a measure no doubt, to the lingering among us of the old Colonial notion that our forests are inexhaustible. But more likely it is due to a characteristic American aversion for spending money on operations where the profits are deferred many years, even for generations. Unlike the French, we acknowledge no indebtedness to posterity.

Our lawmakers have shown this very spirit and when a cry for economy is raised our already meager expenditure for forest protection is cut another notch.

And so we go blithely on, cutting down our timber four times as fast as it is growing and in spite of the fact that the Secretary of Agriculture estimates three-fifths of the country's original timber supply is gone. We are now attacking our last great reserve of timber—the forests of the Northwest.

The migration of the woodsman, from East to West, can be traced in statistics which are available since 1850. Then three-fourths of our lumber came from the Northeast and Central states. In 1918 the same states furnished 15 per cent of our lumber.

In 1850 the Lake states furnished 6 per cent of our lumber. In 1880 thirty-five per cent came from these states, in 1889 twenty-five per cent, and in 1918 ten per cent. In 1850 the South furnished 8 per cent of the lumber used, in 1918, 35 per cent. The Pacific coast gave practically no lumber in 1850, 15 per cent in 1909 and 27 per cent in 1918.

It will be seen that the principal supplies now come from the pine forests of the South and the great wooded mountain slopes of the Pacific states. But already the southern timber is nearing exhaustion and that will leave us principally dependent upon the Pacific coast forests.

The timber-using industries are located mainly in the East and long before the vanishing point is reached in our timber supply, the shortage will be keenly felt in increased costs, as the timber supply moves farther and farther away from the demand.

It must not be imagined that the entire East is denuded of trees or that there is no hope of reforesting there. About 60 per cent of

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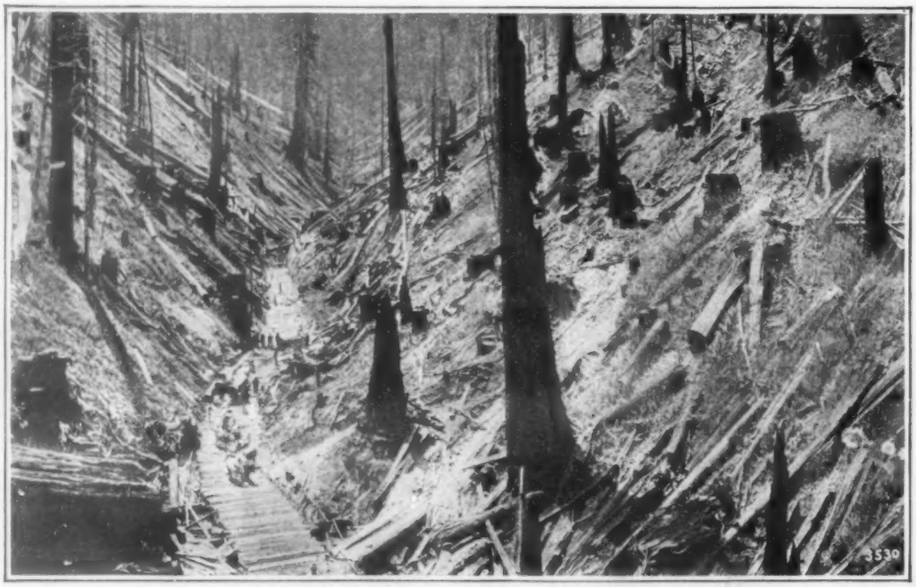
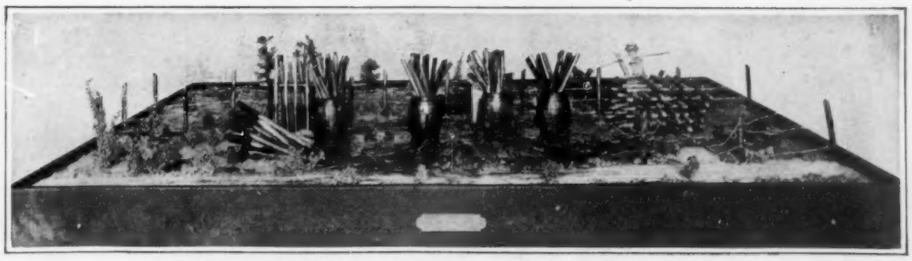


Another view of destructive lumbering in California's redwood belt

Fence Posts That Don't Decay

DECAYING fence posts are familiar sights on thousands of farms, and when probably several million feet of timber is involved, the problem of preservation is one of magnitude. Obviously, every farmer cannot operate an expensive wood-preserving plant which would afford artificial treatment of the posts before they are planted in the soil. How, then, can the resisting-qualities of fence posts be strengthened against the attacks of a low form of plant life called fungi—decay not due to the chemical action of the soil, as is popularly believed?



Forest Service model illustrating the new method of preserving fence posts

The diminutive model, as herewith reproduced, is descriptive of a novel method designed by the U. S. Forest Service whereby farmers can lengthen the life of their fence posts by a simple treatment. Obtain four abandoned barrels, two of which are to be connected with a four-foot iron pipe: the other two containers being disconnected but in close proximity to the twin barrels. Coal-tar creosote, a cheap brownish-black oil, is prepared as a timber preservative. Once the fence posts are seasoned they are soused in the connected barrels where the wood receives a hot bath. A fire built under the connecting iron pipe supplies heat for the liquid inside the two containers. The two isolated barrels likewise contain a coal-tar creosote preservative, the posts being transferred from the warm temperature to these containers where they are given a cold bath.

A model designed to show the effects of tree cover in preventing the erosion of the land surface

Having been thoroughly immersed in the artificial preservative, the farm timber is piled, chicken-coop fashion, for drying. The creosote treatment qualifies in the essential requirements as a preservative of farm timbers: namely, reasonably cheap, capable of penetrating wood, not easily washed out of the wood, and poisonous to the lower plant life which so insiduously pursues its tactics in breaking down fence supports. By giving the posts a hot bath the air and moisture in the timber expand and are partially expelled; when plunged into the two barrels containing the coal oil the remaining air and moisture contract and serve to draw the oil thoroughly into every fiber of the wood.

The time required in administering the simple treatment is largely gaged by the rapidity of penetration and the quantity of oil absorbed. Preliminary experiments suggest that the hot bath should not extend over three hours, with an equal period of time allowed for the cold bath. Seemingly paradoxical is the statement by the Forest Service that the most efficient treatment is the one affording maximum penetration of the substance of the wood, but with a minimum of permanent absorption of oil.—By *F. W. Hyde.*

Geology and Forestry

AMONG the educational exhibits to be found by the visitor in Washington, few are of greater interest or value in their field than those which the Forest Survey has constructed to show the influence of trees and forests upon the action of various geological agents which have contributed to the making of the earth's surface what it is. An idea of the size and character of these may be obtained from the accompanying picture, which displays the model designed to show the effects on erosion of land surfaces. The immediate lesson which this model is intended to emphasize is the influence of trees in preventing erosion; hence the barren stretch which has been washed clean of all soil, and the tree-covered regions above where the destructive faculties of water have found little scope. Between the two areas in question there stands what is represented as a middle ground—temporarily. With its trees cut off and nothing standing on it but stumps, however, it is very plain to the most casual inspection that this section will take on the aspect of the lower level, and within a space of time which, geologically speaking, amounts to nothing at all. A better object lesson of the ultimate consequences of the indiscriminate deforestation which so large a part of the West has suffered could hardly be imagined.

The old road and the new at a point where a simple operation eliminated a sharp curve overhanging a steep bank on this much-used highway

Ironing Out a Dangerous Curve

DANGEROUS stretches of highway are not uncommon but in the elimination of "Dead Man's Curve," on the Washington-Baltimore boulevard, near Elkin, Howard County, Maryland, there remains only a shameful memory of one of the most perilous roadway curves in the United States. Some six or eight persons met tragic endings while thirty-five more or less serious accidents were recorded before the change was made. The original curve extended for a distance of 1,150 feet, and automobiles being directed around the sharp turn were frequently driven over a steep incline or embankment. A vision blurred by the road was likewise frequently impaired by autoists imbibing too freely of intoxicants, when prohibition in Washington, D. C., drove them to Baltimore—all contributing to the menace of "Dead Man's Curve."

The State Roads Commission of Maryland authorized the elimination of the perilous stretch at a cost of $17,000—an insignificant consideration when compared with the toll of life which it annually exacted. The bank at the sharp bend in the road was cut away from the inside of the curve toward Baltimore, the soil being used in making a fill, thus straightening the western end of the dangerous stretch. The curvature at this point has been reduced from 110 to 60 degrees, facilitating an enlarged vision all along the changed location. The new slice of roadway is constructed of concrete and is 20 feet wide.—By *S. R. Winters.*

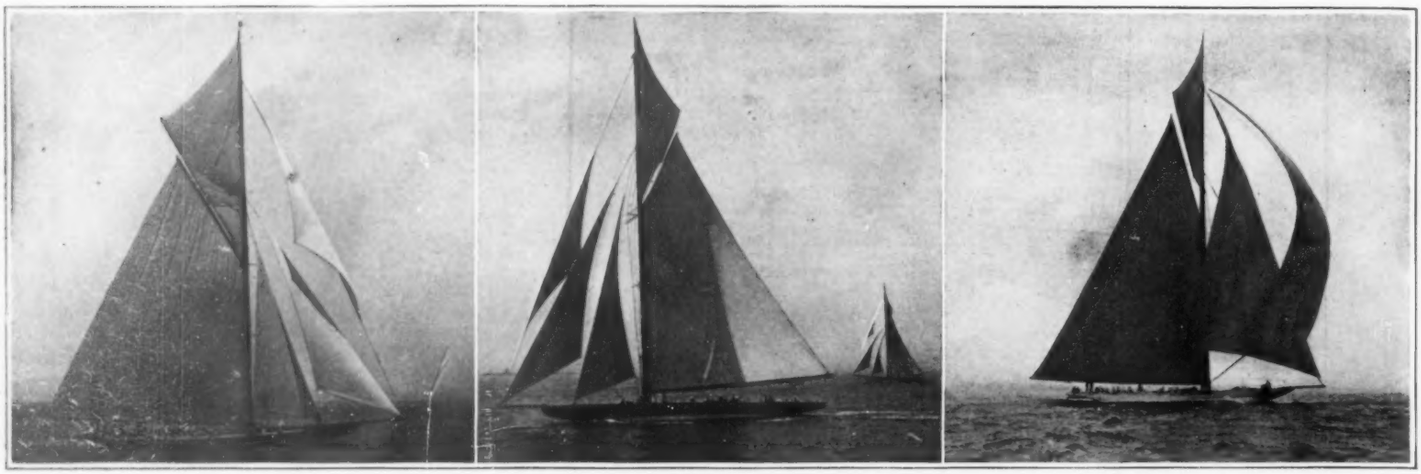
Purple Dye from Shellfish

ON the Pacific coast of Costa Rica, especially in the region about Cocos Bay, there abounds a kind of shellfish called the "nacascol," from which a fine purple color is obtained. So far no way has been found for preserving this dye, and the industry has remained in the hands of the few old people who take the trouble to dye a few ounces of thread every summer. The process is very simple. On picking up the shell from the beach or detaching it from a bowlder, the gatherer blows her breath into it, whereupon a few drops of a greenish liquor ooze out. This liquor is collected in a clamshell, and after a sufficient quantity has been collected the thread is passed through it, very soon assuming on exposure to the sunlight, a beautiful purple color, which is absolutely fast after it has turned purple. It is thought possible that the dye turns fast only on exposure to the air and that the liquor could be preserved by keeping the air away from it. There is little doubt that this industry of dyeing thread could be extended to greater proportions if an extensive demand at good prices could be found for the dye-stuff.

Protecting Peach Trees from Worms

THESE darkies are neither hunting for four leaf clovers nor practising for a revival meeting. They are worming peach trees in order to prevent the costly losses which result from the activities of peach tree borers. The earth is removed from around the crown of each tree to a depth of four or five inches and the trunk brushed or scrapped free of loose bark and dirt. The darkies armed with knives, stiff wires and suitable gouging tools locate and remove and destroy the borers which are fortified in their burrows. Special care must be exercised not to cut the sound bark or wood unnecessarily as carelessness may cause more damage than would result from the insects themselves. After the worming work is completed, the earth is mounded up around the tree to a height of 8 to 10 inches. The base of the tree is also often whitewashed to further protect the trees against peach borers.—By *A. R. Surface.*

A delicate job of cutting borers out of young peach trees



The 23-meter trial horse | Challenger: "Shamrock IV" | Defender: "Resolute"

America's Cup racers of 1920

"Resolute" Defends the Cup

Why "Resolute" Was Chosen and Her Prospects of Defeating "Shamrock IV"

By J. Bernard Walker

ALTHOUGH a great many yachting enthusiasts will be disappointed that "Vanitie" was not chosen to defend the America's Cup, we are in a position to state that the selection of "Resolute" was made strictly on the merits of the two yachts. The Cup Committee realized that the challenger was too fast a boat to allow of any but the very best of our craft being sent on to the Sandy Hook course to meet her; and in trying out "Resolute" and "Vanitie" this year, there was never at any time a thought of playing any favorite—much idle talk to the contrary notwithstanding.

The proof that the Cup Committee was impartial in its treatment of the two defending yachts is to be found in the remarkable improvement shown by "Vanitie" since she came unreservedly into their hands. During the racing of 1914 and 1915 she seemed to be a hopelessly beaten boat; whereas by the close of the 1920 trials, she had several impressive victories over "Resolute" to her credit, and had proved to be so close a match for the Herreshoff craft that in any true wind, whatever its strength, the issue was in doubt until the yachts were over the finish line and the corrections for time allowance had been made.

Never in all the seventy years that have elapsed since the "America" sailed her historic race has a Cup Committee been confronted with a more difficult task in selecting the defending yacht, and the decision was arrived at only after an exhaustive analysis of the results in all of the 1920 trial races. In the first place, all races in which the vagaries of the weather vitiated the result were promptly ruled out of consideration; and a careful analysis was made of the relative performance under conditions when the wind and weather were equally favorable to both boats. Each leg of every course sailed was thus studied and the final choice was made on the total number of points scored by the two yachts. The outcome showed a slight advantage in favor of "Resolute."

To this must be added certain physical characteristics, the consideration of which scored in favor of the selected boat and marked her out as having that slight margin of superiority which might mean the difference between winning or losing. For it must not be forgotten that cup races have been won by 40 seconds, as in 1895 ("Vigilant" against "Valkyrie II") and by 41 seconds, as in 1901 ("Columbia" against "Shamrock II").

At the present writing "Shamrock IV" has shown such a decided superiority over the 23-meter boat that the races between the two have been discontinued and the crews of the boats are being trained in teamwork on the challenger. The failure of the older boat to push the challenger more closely is surprising; for in addition to the fact that in 1912 and 1913 she beat all competitors, winning on time allowance against larger craft and saving her time allowance against smaller boats, she is somewhat faster today than she was then.

This is due to the fact that she was handed over to Mr. Nicholson to make any changes he thought fit that would increase her speed as a trial horse for "Shamrock IV." To this end he added several tons to her lead and lowered its center of gravity. Like all boats built under the International rule, the 23-meter boat had a considerable rocker to her keel, which was 22 inches higher at the forward end than at the stern-post. As she now stands, the bottom of the keel is level. Several tons were cut from the ends of the old lead and this, with the additional lead, was molded on the bottom—the new lead tapering from 22 inches depth at the forward end to nothing at the stern-post.

The additional stability thus secured made possible a large increase in the sail area, so that with all her kites set, the 23-meter boat has nearly as much sail area as "Shamrock IV." She is also eighteen inches longer on the waterline—and length means speed. Her displacement today is 115 tons as against 106 tons for the challenger.

In spite of these changes the new boat, in a topsail breeze seems to be able to beat her about 12 minutes in a 15-mile turn to windward. In a run of 15 miles down the wind, she seems to have an advantage of two or three minutes.

In answer to the question why she cannot pull out a greater lead when reaching and running, we quote a remark of Charlie Barr to the writer: "Any old hooker can go fast down the wind; it's good windward work that wins races."

On the one occasion when the two Shamrocks were tried out in a wind sufficiently strong to call for lower sails only, the old "Shamrock" crossed the line slightly ahead and with the new boat tucked squarely under her lee. Under the stiff wind, the new boat, with her larger sailspread, showed in the puffs fully five degrees greater angle of heel, and both were smoking along at their top speed. "Shamrock IV" pulled clear and showed a gain of 2½ minutes in the six miles to the weather mark; the equivalent of 6¼ minutes in fifteen miles—a remarkable achievement, considering the high rate of speed. Coming home before a freshing wind she gained at the rate of 1 minute 40 seconds in fifteen miles.

And now as to the outcome when Nicholson, a new man in these International contests, meets Herreshoff off Sandy Hook. The 23-meter boat, under her 1912 trim, frequently made an even 12 knots on certain stretches of the course. She is somewhat faster today and "Shamrock IV" has her measure by a good margin on any point of sailing. But "Resolute" has frequently made 12.25 knots for several miles on end.

Let us suppose that "Shamrock" has to allow "Resolute" six minutes over a 30-mile course, say to windward and leeward, and that "Shamrock" barely saves her time—the weather conditions being such as bring out the best speed of both boats. Let us suppose

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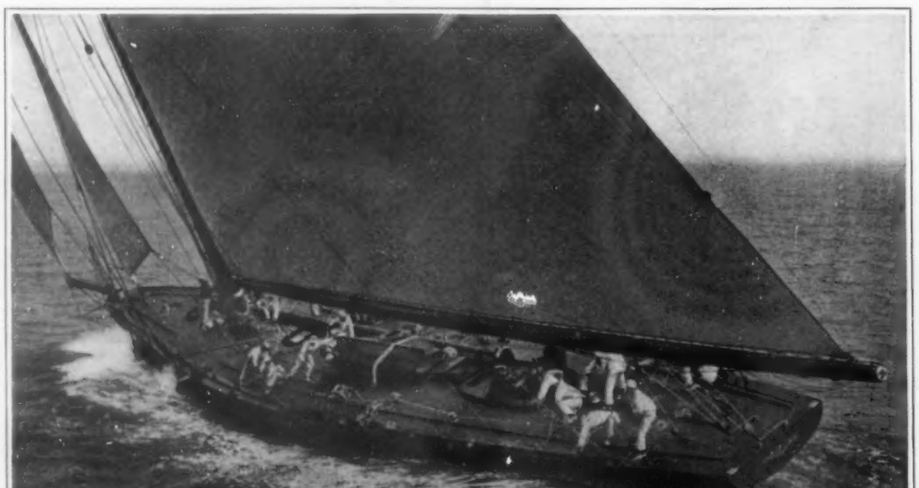
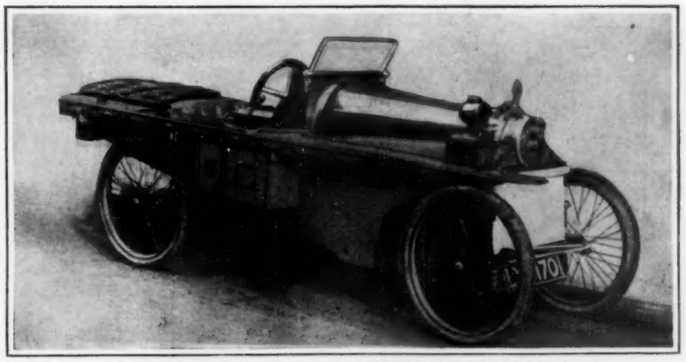


Close-up view of the deck of "Shamrock IV," when she was close-hauled on the starboard tack

The Home-Made Car

THE mechanically-inclined young chap who insists on making all his own things is always with us. In the old days he used to make his own bob-sled and his own racing sulky and above all his own sailboat. Then the gas engine came in, and he began making his own motor boat and before long even his own engine. Today he is busily engaged in assembling his own automobile and his own airplane. Wherever we go, we see among the vast concourse of big and little cars of standard makes a few of these low-hung, spider-webby affairs built to accommodate an engine and as much of the anatomy of a speed-maniac as can be crowded into them.

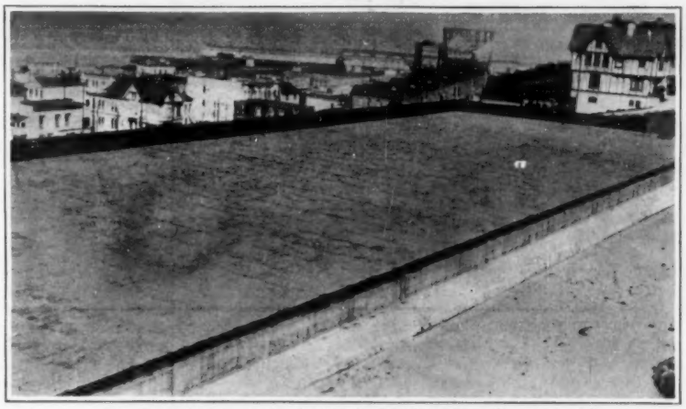
Much attention was recently attracted in the streets of London to the home-made speed bug which we illustrate herewith. The owner and builder seems to have had a talent for pattern-making as well as for machinery, and has made his body of hard wood, picturesquely carved and decorated. The engine and the assembly of the various moving parts presents no feature of startling novelty, although as little cannot be said for the position of the mud-guard. Another ingenious stroke is the use of an ordinary window shade on a roller to prevent the radiator from doing too good a job and cooling the engine below the point of best operation.—By *Ralph Howard.*



The latest thing in home-made flivvers, as seen in London

Sea Gulls Make It Necessary to Cover Reservoir

THE reservoir of the California water company shown in the accompanying photograph was built in the 50's, but recently because of the sea gulls' becoming such a nuisance it became necessary to cover it. The reservoir has existed for all these years within a few blocks of San Francisco Bay, but apparently was not discovered by the sea gulls until the latter part of 1918, when all at once they began to infest it, making it necessary to place guards around it to frighten them away—it was against the law to injure or kill them. What caused the gulls to seek the reservoir is a mystery. They came in such numbers that it was finally found necessary to cover the reservoir. With the completion of the roof over the reservoir a few months ago, the gulls departed as suddenly as they came. The reservoir supplies drinking water to certain sections of San Francisco, and for this reason it was necessary to take this course of action.—By *C. W. Geiger.*

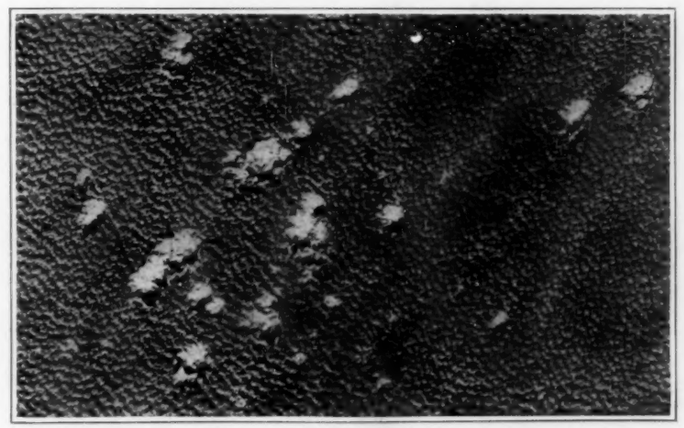


San Francisco's reservoir that had to be covered to protect it from the sea gulls

What the Cattle Tick Does to the Hide

THE educational activities of the Department of Agriculture have made it pretty generally understood that the discomfort suffered by an animal that is infested with fleas or other parasites is by no means the end of the matter—that the financial damage suffered through the deterioration of the creature's general tone by this discomfort, and through the actual physical ravages of the parasite itself, often make it well worth the raiser's while to spend time and money in the effort to free his flocks or herds of the objectionable guests. The photograph which we show herewith affords a striking illustration of this.

The cattle tick, of course, is known by all of us to be an insect pest that lives by sucking the blood of its bovine hosts. But perhaps it does not always occur to us that the skin of a full-grown bull or cow is a decidedly formidable affair, that in order to penetrate this skin and get to the place where the blood is to be found the tick has to do a good deal of excavating, and that when it comes to making leather of the victim's skin the marks of this excavating offer an obstacle. As a matter of fact, the holes made by the ticks in their search for nourishment are responsible for a reduction in market value that averages two dollars for each tick-bitten hide. The extent of the damage may be better understood from examination of the photograph.—By *A. R. Surface.*



What the hide of a bull looks like after the ticks have done their work

Berlin establishment in which clothing for the needy is made from discarded military articles

Plastic Dressing for Wounds and Burns

INDUSTRIAL plants are now using the ambrine treatment for burns, scalds, and all surface wounds which proved very successful for casualties incurred in the world war.

The dressing is a compound of wax and resins, and is solid when cold. It is heated to about 150 degrees Fahrenheit, and applied by means of a special atomizer, or it can be gently daubed on with a soft brush. A plastic dressing, impervious to air, is thus formed, which does not adhere to the wound and which promotes the healing process without appreciable contraction. Disfigurement and scars are prevented to a greater extent than was possible under the old methods.

The outfits can be purchased in two sizes at $17.50 and $47.50 each, and will no doubt be found valuable in first-aid dressing in metallurgical plants, particularly for burns.

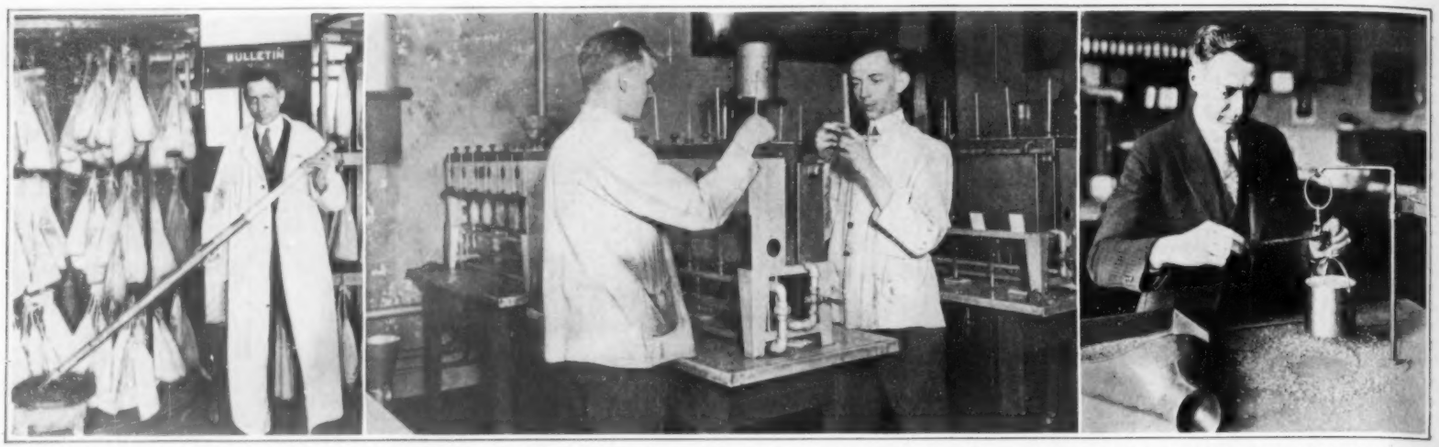
Gas Masks in Pulp and Paper Mills

GAS masks of a nose-breathing type with canisters containing special chemicals are used in the digester house of the Forest Products Laboratory to give protection against sulfur dioxide. These masks enable the operator to make repairs under conditions otherwise unbearable and soon pay for themselves in time saved. Masks of this type are reported by the Bureau of Mines to hold up against a 5 per cent concentration of sulfur dioxide for about 15 minutes. When it is realized that 5 parts of sulfur dioxide to one million parts of air can readily be detected, and that at a concentration of 150 parts of sulfur dioxide to one million parts of air the air becomes unbreathable, some idea can be gained of the life of a canister even under adverse mill conditions.

In addition to their use in the sulfite mill, these masks are of great assistance in the bleach room, where they are worn continuously during the mixing of the bleach liquor. Aside from monetary considerations, the increased comfort and safety of the workmen is sufficient argument in favor of the addition of gas masks to the regular mill equipment.

Working Over the Salvage Pile

THE salvage of discarded army supplies was a game which, as everyone knows, was freely played in France during and immediately after the war; but it may surprise some to learn that it is still being done in Germany. The workroom shown in our photograph was established in Berlin early in the war in the interests of the unemployed, who were here set to work renovating worn-out uniforms, shoes, etc. It has been continued, and others opened, not so much for the sake of making employment as to render it possible for the worst-hit of the city's poor to be clothed. In these shops about a thousand persons, mostly women, are now engaged working over the discarded clothing, hospital linens, gas masks, etc., into wearing apparel and other useful articles, which are sold at rock-bottom cost prices to the people who need them most. The position of those unfortunates whose income has remained practically fixed and who have not the ability or the enterprise to supplement it from irregular sources is so desperate in Germany today that but for measures of this sort it would not be possible for them to exist. When it takes a year's earnings to buy a semi-respectable suit of clothes, anything in the way of a substitute is more than welcome.—By *James Anderson.*



Left: The trier used to take samples of grain from the cars, and a wall-full of these samples, each in its bag. *Center:* Reading a moisture test; the graduate in the hands of the right-hand operator contains the moisture that was cooked out of a sample of corn. *Right:* Weighing the uncooked sample to check against the weight of moisture extracted from it

How grain arriving in Chicago is sampled and tested to see that it is up to grade

The Man Behind Our Daily Bread

Grading and Testing Grain for Sale on the Grain Exchanges of the Country

By Robert H. Moulton

IF you visit one of the large grain exchanges of the country, like the Chicago Board of Trade, for instance, you will see on the trading floor long lines of tables on which are numerous small paper bags containing samples of grain. You may or may not know that these samples came from cars in the freight yards of the city where the exchange is located, and that they are used as a medium by which the entire carload lots are sold and bought. But concerning what happens to these samples before they reach the exchange you are apt to know nothing whatever. As a matter of fact, even the average farmer who raises wheat, corn, oats or some other grain, and who is therefore the person most concerned, has little idea of how his grain is handled after it is shipped from the farm and reaches a terminal market.

Before the samples of grain are displayed for sale on the exchanges they must pass through an intricate process of grading and testing according to rules formulated by the Federal Government. Each state in which the big terminal markets are located, such as those at Chicago, Omaha, Minneapolis and Kansas City, has an official grain inspection department whose duty it is to grade and test every car of grain arriving at that market. By "grade" is meant the quality of the grain as established by the Bureau of Grain Standardization of the Department of Agriculture. Thus, both wheat and corn have six grades, ranging from the best to the poorest, which accounts for the fact that one farmer may receive a better price for his wheat or corn than a neighboring farmer who shipped a similar lot of grain to market at the same time. One may grade high and the other low, and this naturally affects the price paid for it by the grain dealer who buys it through the commission men on the exchange. This difference in price may amount to several cents a bushel.

Practically all of the grain raised in the United States except that used for local consumption is sold on the exchanges. The reason for this is that these institutions furnish a world market. The exchanges themselves do no business, but merely provide a place where buyers and sellers the world over, through their representatives, may meet and trade. In doing so, they perform a valuable service to producers and consumers alike. Most of the grain produced in the United States must be handled within a few months. This means that about one billion bushels of wheat, three billion bushels of corn, and one billion bushels of oats, besides smaller quantities of rye, barley, etc., must be distributed evenly. If there were no machinery for this purpose, there would be hopeless congestion followed by long periods of dearth. The grain exchanges for the country furnish such machinery On the Chicago Board of Trade alone more than 400,000,000 bushels of grain are bought and sold each year. This refers to "cash" grain.

THE housewife who buys food for a large family knows well that only in eternal vigilance is to be found the road to safety. She is well aware that if she does not scrutinize with care everything that she selects, and scrutinize with equal care everything that is delivered to her, she will not get the best grades. She knows that most of the merchants with whom she deals must as a means of avoiding loss sell the seconds and the goods that have got stale or wilted since receipt, and that they will land her with her share unless she is prepared to meet them on their own ground. How, then, she might ask, could she ever be sure of getting what was coming to her if she had to bargain for her purchases weeks and months ahead, without ever seeing them, and if she had to accept delivery from a fifth or sixth assignee of the sales contract which she had signed so long ago? Unless some satisfactory answer to this question can be framed, it must remain a mystery how the grain exchanges, which do business on precisely this future basis, are able to exclude crooked work from their dealings. In this story Mr. Moulton tells us how it is done, how the buyer knows when he contracts for grain just what is coming to him, and how it is made certain that he gets it.—THE EDITOR.

Now "cash" grain might mean little or nothing to the outsider, but to the man in the trade it means grain intended for immediate delivery; that is, grain which is actually in cars or elevators in the terminal markets, and which can be delivered immediately to a purchaser. There is another department in which grain is bought and sold for "future delivery" but that is merely another chapter of the same story.

The Illinois State Grain and Inspection Department, which prepares samples of grain for sale on the Chicago Board of Trade, has frequently handled more than 30,000 cars of grain in one month, and its record for a single day's work done is 2,520 cars, of which 1,472 were corn. The latter is more difficult to grade than any other grain, as it requires the moisture test recently established by the Federal Government. The offices of the Grain Inspection Department in Chicago employ 25 deputy inspectors, 50 grain samplers, and a large clerical force.

Early every morning the grain samplers go to the freight yards where cars of grain have arrived overnight and take samples of each car. The sampling is done by means of an instrument known as a "trier," which consists of a 2-inch metal pipe 6 feet long, with a pointed end, in which are cut, at intervals of five inches along one side, eight holes about 4 inches by 1½ inches. A smooth wooden pole fits snugly into the pipe, closing all the holes. In using the "trier" it is shoved into the grain, down to the bottom of the car, and the pole is then gradually withdrawn, opening the holes, and allowing the grain to enter the pipe from various openings in the trier. The sampler is thus enabled to get a sample that will determine whether or not the grain in the car is all of one quality.

The sample thus taken is placed in a cloth bag together with a ticket on which is marked the initial and number of the car, and a notation showing the condition of the car at the time the sample was obtained. These sample tags are carried to the offices of the State Grain Inspection Department and the grain therein is inspected and graded by expert graders. A grain inspector must possess good eyesight, a keen sense of smell and a very acute sense of touch. These qualities are of vital importance, especially in the inspection and grading of wheat. The inspectors are all men of practical experience in the grain business who have passed rigid civil service examinations under the supervision of the Illinois State Civil Service Commission. These men stand before large tables on which the sample bags are placed. The inspectors open the bags and pour the grain into pans especially made to receive the contents of the bags. These pans are provided with funnel-shaped ends so that the grain may easily be poured into the

(Continued on page 74)

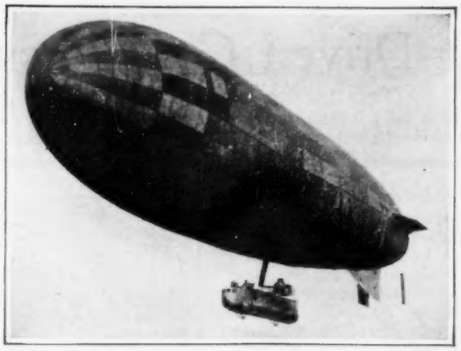
The Illinois State Grain Inspection Department, where the work of sampling and grading of grain is done

The Akron-Detroit Dirigible Express

A BIG step forward in the development of commercial aviation in the United States is about to be taken by one of the big mid-western rubber concerns, which has purchased a Chalais-Meudon dirigible from the French government, and plans in September to establish the first inter-city airship line. Daily round trips will be made between Akron, the headquarters of the rubber industry and a place which most of us are only now learning in the light of the census figures to recognize as a city of the first class, and Detroit. For the first month or so, while the route and the ship and the navigators are being tried out, it is planned to carry only mail and express; after that it is probable that a passenger service will be attempted.

The airship to be employed has 320,000 cubic foot capacity, is 260 feet long and motored with two 250-horse-power engines which will drive it at a maximum speed of about 50 miles per hour. The cabin is 45 feet long, and when changed from its present war-time design to that of commercial construction it will accommodate about thirty passengers.

This ship was built for use in the war, of course, but was completed too late for service. No time schedule has been made up for the 150-mile trip between Akron and Detroit, but it will of course be much faster than the rail trip. The former United States Navy air station at Wingfoot Lake, Akron, has been secured for one terminal, and pending the arrangement of suitable housing in Detroit it is anticipated that a mooring mast will be used. Surely two cities with more interests in common than the automobile and the tire centers of the universe could not have been selected for this first effort at regular commercial airship communication—nor two cities whose present facilities for communication are more in need of improvement.



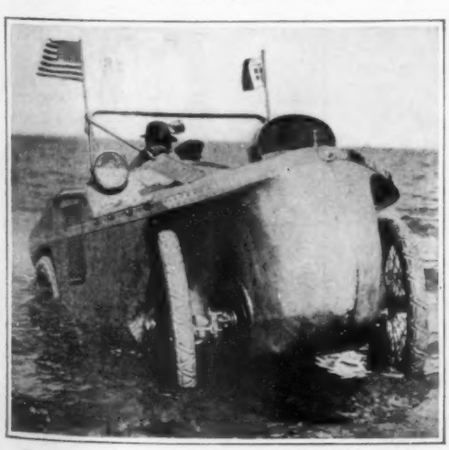
The airship of French design with which it is planned to start regular service between Akron and Detroit

The Sea-Going Automobile

WHAT with the hydroplane and the flying boat, we have a multiplicity of machines that are designed to discharge more or less satisfactorily the dual function of airplane and motor boat. But what shall we say of the bold constructor who puts forward a combination of automobile and speed-ship?—a motor car-boat, perhaps we may call it.

The interesting machine which is illustrated herewith is the "Sirena," and is now on exhibition at Atlantic City. It is a fully equipped motor car capable of making the speed of sixty miles an hour, anything less than which is today unworthy of the term of speed in land propulsion. It differs in design from the conventional car mainly in the very substantial bottom, the reason for which is immediately apparent when we reflect upon its secondary use; the ordinary carburetor, magneto, etc., would hardly function to the satisfaction of a particular driver if the car in which they are mounted were submerged to the gunwhales, and the spark-plugs might likewise have something to say about this semi-aqueous mode of operation. However, with the cruiser bottom with which this machine is supplied, she takes the water very nicely. A simple clutch throws the transmission off the wheels entirely and starts the engine to driving a propeller at the rear of the body—which, believe it or not according to your individual predilection, the maker assures us is absolutely watertight. As a boat the strange combination is capable of a speed of 20 knots. For those who insist upon sedan or limousine, the manufacturers say that they expect shortly to have such models.

We do not know just how popular this idea is going to be with the tire manufacturers, but perhaps if the front-wheel suspension will stand it the tires can be depended upon for good performance.



An automobile on land—a speed boat in the water

A Tree with Four Legs

NATURE has produced many freak trees, but one of the oddest forms ever created by human action is a four-legged tree standing at the entrance to the home of a Bridgewater, Mass., man. This tree has all the appearance of a single tree trunk with four spreading legs. As a matter of fact, the trunk is the combined trunks of four white elm saplings planted in a group and bound closely together about twelve feet from the ground, a good many years ago. In time the trunks grew into one, and this strange arboreal quadruped is now a large and sturdy tree. It is known locally as the "wishing tree," the legend running that a wish made while one is walking in and out among the four legs will come true.

Demonstrating that a quadruped is not always an animal

Wood Firing on European Locomotives

IN Sweden, as in Switzerland, because of the fuel shortage, as a temporary measure, locomotives had to be fired with wood. The experiments made in the latter country were comparatively successful. The start was made on the Bodensee-Taggenburg Railroad, where steam was got up by means of wood firing, resulting in a pressure of from 5 to 6 atmospheres derived from one cubic meter of wood. Not only was the cost fifty per cent less than that of a similar quantity of coal, but the time required for getting up steam was shortened. Consequently firing by means of wood was instituted for the trip; but difficulty was encountered in finding sufficient room for the amount of wood needed. Finally, special cars were added to the trains to carry the wood.

The wood is cut into blocks and burned the same as briquettes. The same high class service resulted as if coal had been used. Four square meters of first class beech wood or five cubic meters of mixed wood (beech, pine, etc.) were about equivalent to one ton of first class coal. An average train required 152 tons and 68 cubic meters for 1,000 train kilometers; 16 tons of coal would have been required for the same trip.

Because of the high price of coal in Switzerland during the war, the firing of trains by means of wood proved to be an economic success. A disadvantage lay in the stream of sparks caused by the burning wood. The addition of pitch, which possesses from 7,500 to 8,000 calories of heat, is quite successful.

Dehydrating Crude Oil Electrically

CRUDE oil often contains water which must be removed and this is not always easy. The usual methods are the application of heat, centrifugal force or chemical action. A new method is by the use of electricity which has proved superior to the others.

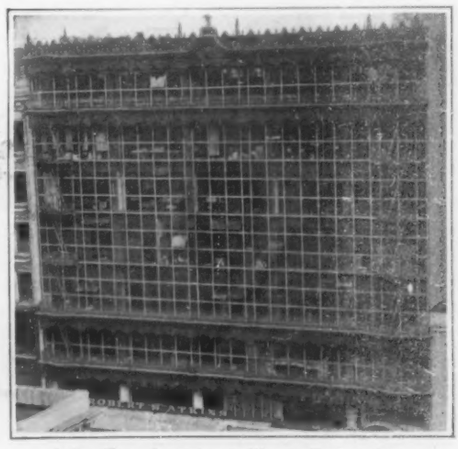
When present in the form of large free globules, water will settle out from oil by gravity, but if the water is in a state of emulsion with the oil, it will not settle out at normal temperatures and pressures, even if the mixture be allowed to stand indefinitely. The removal of water at the well effects an important reduction in freight costs, besides eliminating the clumsy practise of allowing purchasers a rebate on the percentage of water which they were able to prove was contained in the crude oil hitherto delivered.

There are 17 electrical dehydrating plants now operating in the Whittier District in California, and in many cases oil hitherto unfit for use is made marketable by electrical dehydration. The oil treated ranges from 15 to 50 per cent of water, and the consumption of electrical energy is about one kilowatt-hour per 18 barrels of dry oil. The electrical dehydration causes practically no loss of gasoline, and the gravity of the oil is raised one or two degrees by the treatment. This increases the value of the oil sufficiently to pay all or part of the cost of treatment. The heating process, on the other hand, involves more or less deterioration of the oil. Careful tests indicate that, under the same conditions, the heating process costs 7.5 cents per barrel, compared with 1.5 cents per barrel (or 2 cents, including royalty) for the electrical process.

Usually, the electrical dehydrator operates on single-phase alternating current at 11,000 volts. The emulsion of oil and water is passed between highly-charged electrodes, and the effect of the electrostatic field is to coalesce the particles of water and also coalesce the particles of oil. The water then settles readily by gravity. The average maximum demand per dehydrator is 4 kilowatts, the average load factor 50 per cent, and the average power factor 98 per cent leading. In districts where water is scarce, the water separated electrically has considerable value.

People Who Live in Glass Houses

IF there is anything in the old saw, the proprietors of this big clothing store in San Francisco will have to be very circumspect with regard to the hurling of missiles. They boast that their street-front is "all glass," and it comes about as close to justifying the claim as any type of construction that we have ever seen. It is to be hoped that the Golden Gate does not become the scene of a repetition of New York's "Black Tom" explosion, which blew out windows twenty miles away—if it does, we can see where there will be work for the California glaziers. But even such a disaster might be a fair price to pay for the extraordinary lighting which the interior of this building must enjoy.

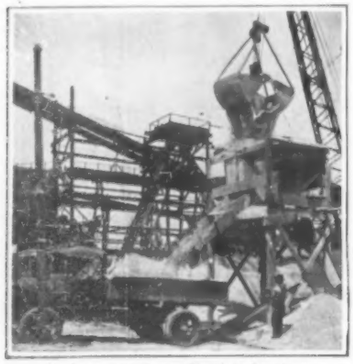


A San Francisco store with an all-glass front

The Motor-Driven Commercial Vehicle

Conducted by MAJOR VICTOR W. PAGÉ, M. S. A. E.

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any question relating to mechanical features, operation and management of commercial motor vehicles



A short cut from digging bucket to truck

Economical Truck Loading

THE illustration herewith shows a five-ton truck of standard make used by a contracting firm in Cleveland, and shows how a simple and rough hopper structure can be utilized in loading motor trucks economically when these are employed in hauling away excavated material. As will be evident from the illustration, the hopper is loaded by the usual form of clam-shell excavating-bucket, which in this case is handled by the conventional form of steam-operated derrick boom. The hopper, which has a capacity for several truck-loads of material, is carried on substantial columns of such height that it is an easy matter for the truck to back down underneath the loading chute. The floor of the hopper is inclined sufficiently so that as soon as the hopper gate is opened the material will drop down the chute into the truck body. It will be apparent that trucks may be loaded as fast as they can be driven under the chute. The surplus capacity of the hopper makes it possible for the clam-shell bucket to discharge its load even if there is no truck waiting to receive the material.

Improved Type Combination Farm Body

THIS body is of the combination stock-and-grain type of especially heavy construction. The bottom panel is 14 inches high, being built solid to the body. As illustrated in the photograph the stock rack, which is 50 inches high, is constructed to be lifted off by one man, either in sections or as a unit. When off, this rack is replaced by a 10-inch grain panel which is shown in the photograph. This forms a solid grain body. The stock rack is equipped with a hog gate in the rear which can be entirely removed if desired. The sills and sub-sills of the combination body are constructed entirely of heavy kiln-dried oak, while the panels are built of genuine yellow poplar.

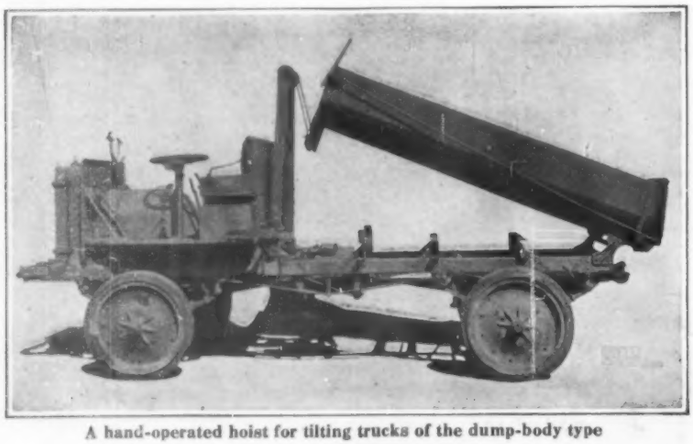
Draw-Bar Pull of Trucks

ILLUSTRATIVE of the pulling power of the motor car over the horse, the Labor Day parade of a decade ago was not complete unless one float consisted of an automobile, dragging a trailer on which a dejected horse or two were trying hard to maintain their equilibrium. Now is presented the picture of the pulling power of a motor truck, which towed a huge freight locomotive for two city blocks without any difficulty. It was a five-ton truck that did the trick and the place was Seattle. The demonstration of pulling power was arranged

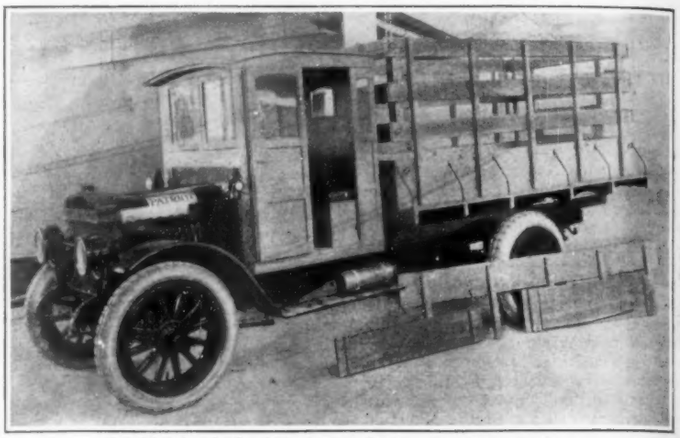
Showing what a truck can do

as the result of a wager between the division freight and passenger agent of the St. Paul Railroad and a prominent automobile enthusiast.

The locomotive's weight was 309,480 pounds and the truck weight less than one-thirtieth as much. To give the truck traction it was loaded with nearly five tons of cement and was then backed to the front of the engine. Heavy chains were used from the draw bar of the locomotice to the truck frame. The skeptical one signaled the start and the truck moved forward. There was an instant's halt as the dead weight of the locomotive resisted movement and then the steam engine began to move slowly. The rest of the two block tow was naturally uneventful, the engine following the truck easily enough after the initial resistance of starting was overcome.



A hand-operated hoist for tilting trucks of the dump-body type



Combination body that serves all purposes about the farm

Heavy Duty Tractor

ILLUSTRATIONS have been presented from time to time in these columns to demonstrate the utility of the various forms of tractors and semi-trailer outfits in hauling large loads of various classes of material. The accompanying illustration depicts a semi-trailer outfit owned by a San Diego, California, produce company, which operates about the city carrying big loads of produce that come in by boat and train to the commission houses. One of the big advantages of the use of the tractor and semi-trailer outfits similar to that illustrated is that it is not only possible to handle large loads but that the trailers are

The semi-trailer in close quarters

very easily maneuvered in congested spaces that are so often found around docks, factories or warehouses. It is easy to handle the heavily loaded trailers by maneuvering the tractor, in fact heavy loads can be moved much more easily than can be done with either horse-drawn vehicles or the conventional types of motor trucks of sufficient capacity to carry the loads.

Hand Operated Hoist

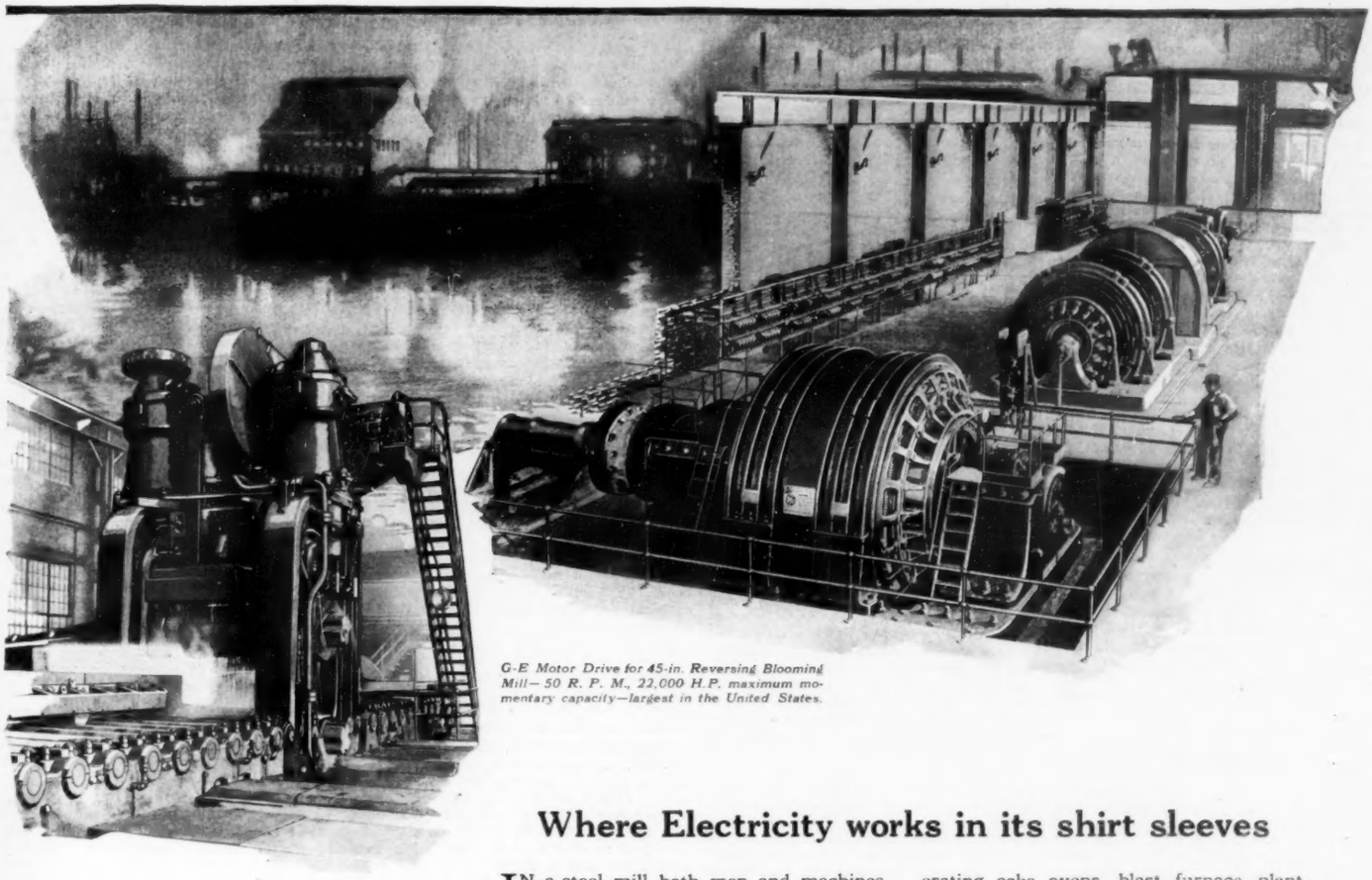
A VERY simple and useful device that can be fitted to any motor truck is illustrated herewith. This is a hand-operated hoist that is used for tilting bodies of the dumping type. The hydraulic hoist as ordinarily used on motor trucks depends on the engine power for its operation and is somewhat too costly for installation on trucks that are used only intermittently for dumping purposes.

The hand-operated hoist may be obtained as a complete unit and is readily installed on any motor truck chassis as indicated. It is a substantial affair of structural-steel channel-section members and plates which completely enclose the actuating gearing. It is provided with pads at the base by which it may be securely attached to the motor-truck chassis by means of special U-bolts which encircle the pads and the motor car frame. The body and lifting cables are attached to arms which are furnished with the device and which are bolted to the front of the body. The body is hinged on the rear end and is provided with a hinged tail gate which may be controlled from the front end of the body by a suitable lever and rod connection.

A feature of interest is the form of crank provided, which is adjustable so as to secure various ratios of leverage, depending upon the weight to be lifted. The crank arm slides in a special member which is attached to the square end of the shaft operating the gearing. It is held in place in this socket by a pin, which can be set into any one of the holes provided along the length of the crank arm. An automatic ratchet is used so there is no possibility of the hand crank's reversing its direction of rotation due to the load lifted. The gearing is simple and provides a good leverage. The cables, which are attached to the lifting arms on the body, pass over sheave pulleys to a specially formed winding-drum of the winch mechanism on the base of the hoist.

Details of hand-operated tilting hoist

The unlimited adaptability and easy control of electricity stimulates the development of great and small machines which mark the achievements of industrial progress



G-E Motor Drive for 45-in. Reversing Blooming Mill—50 R. P. M., 22,000 H.P. maximum momentary capacity—largest in the United States.

Where Electricity works in its shirt sleeves

IN a steel mill both men and machines must put forth the best that is in them—strength, endurance, speed, accuracy—all these are essential in either case. And the electrically driven machine has qualified for the hardest job of all.

As the white hot ingot of steel is carried on rolls back and forth under the blooming mill, it is literally squeezed into a bar, which grows longer as it grows thinner, and finally passes along to the bar mill. The blooming rolls must not fail, since production is so largely dependent upon their continuous performance—therefore G-E reversing motors are assigned to this strenuous task.

In other parts of a modern steel plant, G-E motors shoulder the heavy burdens just as faithfully—unloading coal and ore; operating coke ovens, blast furnace plant, open-hearth plant, sheared-plate mill, universal plate mill, and sheet and tin-plate mill. In one plant the installation of electric motors—the majority of which are G-E—totals 240,000 horse-power.

Where electric motors replace steam or hydraulic power, they occupy less space, are controlled from a central point, require in nearly every instance only one operator, and produce greater tonnage at a lower average cost—as proved by actual installations under various working conditions. The many advantages obtained through the use of G-E Motors and Control are at the disposal of all who invite the co-operation of the General Electric Company's steel mill specialists.

General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

4-350

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Aeronautics

AIRPLANE.—H. C. NEAL, c/o H. T. Green, Philadelphia, Miss. An object of the invention is to provide an airplane embodying a construction whereby the airplane acts as a parachute in the event that the engine stops, so that the aviator may safely land on the ground. A further object is to provide mechanism capable of adjustment and operation while the machine is in motion to enable the airplane to remain in substantially one position to facilitate observations, or to remain vertical or in its normal position, when standing on the ground, and while in motion.

Electrical Devices

ELECTRIC MOTOR.—L. FOOTE, Paraiso, Canal Zone, Panama. This invention has for its specific objects the provision of a field structure in which two rings or cylinders of the same diameter are arranged and a common axis, there being spaced teeth on the meeting edges of the rings, all the teeth of one ring being of one polarity and those of the other of opposite polarity, and the rings are so arranged that the pole teeth of one ring extend into the interpolar spaces of the other ring, whereby a plurality of closely arranged alternate poles are produced.

ARC CURRENT REGULATOR.—J. A. HOLLFIELD, 1300 Church St., Mobile, Ala. The invention has for its object to maintain a substantially constant current within the limits of voltage desired for the arc in question. The invention is of special value in the arc of electrical welding as it is adapted to maintain constant current in the arcing circuit at all times without the presence of dead resistances and will function in an ideal manner to make a weld without burning places, globules or pitting.

Of Interest to Farmers

AUXILIARY FLOOR FOR THRESHING MACHINES.—G. R. LUNDY, Niagara Falls South, Ontario, Canada. The invention has for its object to provide means for catching the falling grain from the feeder of the thresher, and wherein means is provided in connection with the said means for permitting the contents of the first sheet to be emptied into a particularly closed receptacle for convenience in dumping the same.

Of General Interest

COMBINED BATHTUB AND DRESSER FOR BABIES.—E. L. NICKELS, 1243 W. Center St., Rochester, Minn. The invention has for its object to provide a device of the character specified; especially adapted for the use of babies, wherein the bathtub is built in the dresser, which is provided with a sliding top for covering the bath, capable of being slipped aside to provide a supporting surface for the baby after it has been bathed; the dresser also being provided with means for holding supplies.

SAFETY CATCH FOR BROOCHES. — B. BOCCACINI, c/o Tiffany & Co., 5th Ave. and 37th St., New York, N. Y. This invention relates to articles of jewelry or the like, and has particular reference to safety catches for cooperation with the pin portion of brooches, breast pins or emblems to prevent the accidental or unauthorized opening of the pin from its holding catch. More especially the device comprises a pedestal or frame made of any suitable quality of material such as sheet metal and so stamped and folded as to provide not only a seat for the pin but also a space between the seat in which is pivotally mounted the keeper.

COOKING UTENSIL.—L. ARMBRUSTER, 510 W. 134th St., New York, N. Y. This invention relates to a cooking utensil; the aim is to provide a device wherein fluids such as milk may be brought to a temperature just below boiling without any danger of the same overflowing the side walls of the utensil, or scorching, as is now the case.

SUPPORTING LEG FOR WASHTUBS.—T. S. CASNER, 768 Kensington Ave., Plainfield, N. J. The invention particularly relates to a detachable leg for supporting a tub in elevated position. The object is to provide a detachable tub leg of simple and efficient construction, having means associated therewith for rigidly gripping and supporting the tub, which is adjustable to accommodate tubs of various heights.

WRIST WATCH HOLDER. — E EISENBECHER, Ultramares Corp., 280 Broadway, New York, N. Y. An object of the invention is to provide a device, which when the wrist watch is in position thereon, will have the appearance of a clock, or for display purposes. A further object is to provide a device which provides an elevated mounting for a wrist watch and bracelet or strap, and a centering recess to hold the watch in proper position.

REINFORCED CONCRETE FLOOR CONSTRUCTION.—D. J. FLYNN, 190 George St., New Brunswick, N. J. The object of the invention is to provide a reinforced concrete floor construction, reinforced longitudinally and transversely to render the floor exceedingly durable. Another object is to provide a floor with voids thereby making the floor exceedingly light. A further object is to permit of conveniently and quickly forming the floor without requiring highly skilled labor.

LUMINOUS THERMOMETER.—G. P. PITKIN, Bergenfield, N. J. The invention has for an object to provide a thermometer which can easily be read in the dark. A further object is to provide an attachment which can be placed on any ordinary thermometer tube and which will disclose the position of the expansible column in the dark as well as in the light.

ALLOY.—F. MILLIKEN, 55 John St., New York, N. Y. This invention has been granted two patents on alloys formed from copper, nickel, iron and zinc, under the influence of chromium or tungsten. The objects of the inventions are to provide an alloy characterized by having a high acid resisting quality, an increased density, an exceedingly close and fine grain, great tensile strength, increased elasticity and electrical resistance. The alloys consist of copper 50 to 60 per cent, nickel 26 to 34 per cent, iron 4 to 8 per cent, zinc 7 to 11 per cent, and .25 to 5 per cent of tungsten or chromium.

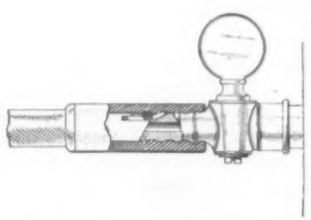
Hardware and Tools

ATTACHMENT FOR WRENCHES.—L. A. BANTA, A.A.F.C., 36, Fellows, Cal. An object of the invention is to provide an attachment tool for socket wrenches which may be used in connection with socket wrenches for expediting the removal of cap screw bolts. It is a purpose to provide a tool of this character which will find a broad range of convenient uses in and around automobiles during the assembly and disassembly of the parts, and in other mechanical operations.

WINDOW LOCK.—R. BELLINGER, 226 E. Main St., Chicopee Falls, Mass. This invention relates to window locks; its general purpose is to provide a device which will lock a window in closed position or in any one of several open positions so as to secure ventilation at the top or bottom of the window or both. It is also a purpose to provide a lock when in locking position prevents rattling of the window.

Heating and Lighting

SAFETY GAS COCK.—B. J. DIEHL, Dry Harbor Road and Cooper Ave., Glendale, L. I., N. Y. The invention aims to provide a device wherein the accidental displacement of the conventional rubber tube from the end of



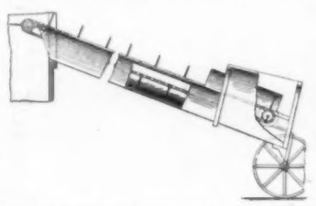
A SIDE VIEW PARTLY IN SECTION, OF A COCK WITH THE SECONDARY VALVE IN OPEN POSITION, AND MOUTHPIECE OF A RUBBER TUBE APPLIED

the gas-cock will result in the automatic shutting off of the flow of fluid. A further object is to provide a secondary valve for the nozzle in addition to the conventional turn valve, the secondary valve automatically cutting off the gas, should the tube be accidentally pulled off.

HEATED AIR SUPPLY APPARATUS FOR CLOTH DRIERS.—F. F. MCIVER, JR., Mandel McIver Co., 1805 1st Ave., New York, N. Y. Among the principal objects of the invention are, to avoid the necessity of providing a vertical support for cloth, to rest the supply of cloth in position for feeding the same to the drier, to prevent creasing the cloth while waiting to be dried, to economically heat air for supplying the drier and control the heater, and to avoid transmission of heat from the pipe supplying heated air to the casing thereof, forming a support for the cloth preliminary to drying.

Machines and Mechanical Devices

GRAIN ELEVATOR.—J. B. MAJERUS, Bellechester, Minn. This patentee has produced a simple elevator of practical utility. It has running wheels at the rear and is adapted to be attached to any vehicle in transporting it from one place to another. When hauled to a barn or the like and positioned its trunk is inclined and the wheels removed for opera-



A SIDE ELEVATION, PARTS BEING BROKEN AWAY AND OTHERS IN SECTION

tion. The elevator is readily adapted to be given an angular position to suit the point of delivery. The grain is elevated by an endless belt with simple drive gear. A hopper is included into which the grain is shoveled or dumped.

APPARATUS FOR ICE MAKING AND REFRIGERATING PURPOSES.—C. DELAYGUE, address A. Montelhet, 90 Blvd., Richard Lenoir, Paris, France. This invention relates to an apparatus for ice making, and mechanism is provided for evaporating in a closed vessel, by heat or other suitable means, a liquid in which are dissolved easily vaporizable substances, having a great affinity for the liquid, and in providing means for recovering and condensing the vapors in a second closed vessel constituting a refrigerator, and in finally producing in the said refrigerator the revaporization of the condensed products by contact with the substance to be cooled or frozen.

MACHINE OILER.—J. M. BUKACEK, Clarkson, Neb. This invention has for its object to provide an oiler adapted for use with machinery of any character, which may be made to positively deliver oil when desired, whatever the position of the oiler. The arrangement is such that when the handle is pressed toward the can a plunger is moved downwardly, thus forcing out the oil through the spout.

Medical Devices

COMBINATION TRACTOR AND REPELLER.—P. C. JUHL, Princes Bay, S. I., N. Y. The invention relates to obstetrical instruments; its object is to provide a combination tractor and repeller more especially designed for use by veterinary surgeons on cows, horses, and other animals with a view to adjust abnormal position of a fetus. Another object is to enable a veterinary surgeon to readily apply and manipulate the instrument.

Musical Devices

NEEDLE.—C. A. PORT, Windsor Mo. The invention has for its object to provide means for firmly holding a filament of wire against movement away from the record and for connecting the said filament to the needle holder of a talking machine in such manner that the wire may be used to engage the record.

Prime Movers and Their Accessories

SUPERHEATER FOR INTERNAL COMBUSTION ENGINES.—H. A. LACERADA, 3258 Hudson Bldg., Jersey City, N. J. The object of the invention is to provide a superheater for internal combustion engines such as are used in automobiles, marine and aerial vessels and the like, and arranged to generate superheated steam and to supply the same to the explosive mixture to increase the efficiency thereof and prevent the formation of carbon and other deposits in the cylinder. Another object is to dispense with the usual overflow pipe in the radiator.

SPARK PLUG HOLDER.—C. E. WAKE, 509 E. Sumach St., Walla Walla, Wash. The invention has for its object to provide a device for conveniently handling spark plugs without danger or discomfort from the hot plugs, and without the necessity of soiling the hands. A further object is to provide a spark plug holder which grips the plug but which can be easily released therefrom by pressing the handle members toward each other.

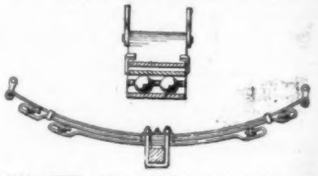
Railways and Their Accessories

RAIL PLATE AND FASTENER. — J. G. HILL, 512 Railroad Exchange Bldg., Kansas City, Mo. The invention relates generally to track securing devices, and more particularly to a simple, economical rail plate and fastener, the object being the provision of an effective device which may be used in practice with great advantage, in order to prevent overturning and creeping of rails as well as an arrangement whereby the rails may be readily released and removed when substitution becomes necessary.

Pertaining to Vehicles

TIRE FOR MOTOR VEHICLE.—J. J. DANA, 17 W. Anderson St., Savannah, Ga. The object of this invention is to provide a tire having the resiliency of a pneumatic tire, without the liability of the same to puncture and blowouts, and wherein the resiliency of the tire may be varied to suit conditions. The tire is characterized by a series of housing plates which permit of a limited hinge motion, and a tread ring of rubber or the like on its outer face.

BALL BEARING SPRING.—G. A. SAVILLE, Jr., 619 So. 11th St., Lincoln, Neb. The invention has for its object to provide a spring especially adapted for motor vehicles, but suitable for vehicles of any character, wherein all bearings are arranged between the leaves



A SIDE VIEW AND SECTION OF THE SPRING CONSTRUCTION

of the spring at the ends of the said leaves, a bearing being arranged at each end of the leaves between the said end and the adjacent leaf for making the spring more flexible, reducing wear and increasing resiliency.

LICENSE TAG HOLDER.—T. J. CHAPPELL, Castleton, N. D. This invention has for its object to provide a simple, inexpensive device of the character specified which may be detachably connected with the hood of a motor vehicle, and with the license tag in a manner to be easily removed when desired, and wherein the holder has means for preventing swinging of the crank.

VULCANIZER.—E. D. HOSTLER, Tipton, Iowa. The invention relates more particularly to a mandrel for use in vulcanizing the ends of the inner tubes for automobile tires and the like, an object being to provide a device which permits the tube ends to be vulcanized on the outside thereof, thus permitting a ready manipulation of the tube so as to insure a proper positioning of the parts and also permit a full observation of the vulcanizing process.

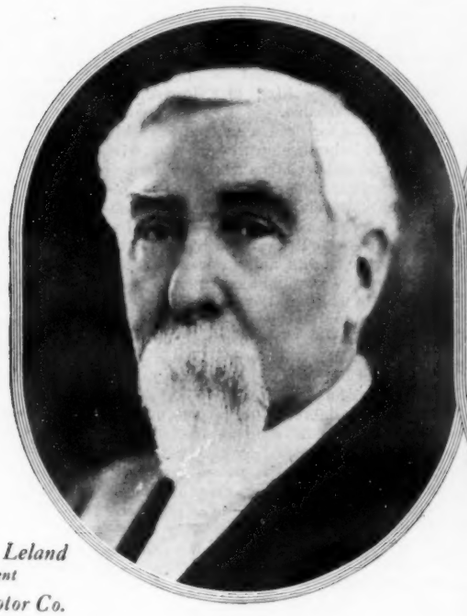
Designs

DESIGN FOR AN INHALER.—E. H. METCALF, Marlboro, N. H.

DESIGN FOR A BRIDGE PLATE FOR WATCH MOVEMENTS.—C. F. COLOMB, 30 W. 36th St., New York, N. Y.

The Leland Contributions to Motordom

Pioneers of the Industry, Henry M. Leland and Wilfred C. Leland, Organizers of the Lincoln Motor Company have been outstanding factors in Motor Car Development



Henry M. Leland
President
Lincoln Motor Co.

Wilfred C. Leland
Vice-Pres. & Gen'l Mgr.
Lincoln Motor Co.

Looking back over the progress of a generation, it would be difficult to recall anything which has contributed to the welfare of civilization and to the healthful enjoyment of mankind more than has the motor car.

Recalling the achievements which have marked the beginnings of various epoch-making periods in motordom, where do you find examples more impressive or which have been more far-reaching in their influence than those inaugurated by the Lelands during the past eighteen years, with the co-operation of thousands of skilled and loyal associates;

—the first practical, enduring car, made in large numbers;

—the thorough standardization and interchangeability of parts;

—close and fine workmanship, expressed by accuracy measured in thousandths of an inch and even in fractions of a thousandth;

—the initial adoption in motor car workmanship of the Johanssen gauges, accurate to the one-hundred-thousandth part of an inch—instruments which have helped to make possible such wonderful precision;

—scientific practices and methods in manufacture, which made possible a car of highest quality, at a price then far below prevailing figures for a comparable product:

—the electrical system of starting—lighting—ignition;

—the thermal regulation of the water circulating system;

—the V-type, *high-speed, high-efficiency* engine, the influence of which upon the industry has been almost immeasurable?

As a crowning achievement, one has but to observe their record both as to quantity and quality of Liberty aircraft motors.

And to the Lelands is due a multitude of other things—in manufacturing practices and in motor car refinement—some seeming small in themselves perhaps, but almost limitless in their influence and incalculable in their value in making motor cars the wonderful mechanisms they are today.

The Lelands have been favored by an additional advantage in that usually they have been afforded first opportunity to consider new devices developed by independent and unaffiliated genius.

This because it was realized that the seal of Leland approval spelled success in motordom, and that generally it meant ultimate adoption by other good-car makers.

Entering the industry practically at its inception, the Lelands soon became recognized as possessing two predominant traits: first, to achieve and to surpass—for the sheer satisfaction derived from those accomplishments: second, to strive unceasingly for the betterment of motor cars, in everything that betterment signifies—to make them more trustworthy, to make them more enduring, to make them a source of greater comfort, to provide greater conveniences, to make their care and their operation unirksome—in short, to make their possession more desirable from every viewpoint.

Is it not logical, therefore, that men recognized as foremost exponents of advanced ideas, will guard and preserve that enviable distinction?

In the light of past accomplishments, could anything be more logical than that the new Leland-built car will embody refinements naturally to be expected of men occupying positions in the forefront of advancement—positions to which the serious-minded in the industry are wont to aspire?

And in the light of past accomplishments, could anything be more logical than that the new Leland-built car will uphold Leland traditions: and that it will evidence, more impressively than ever before, Leland determination and Leland ability to achieve—and to surpass?

LINCOLN MOTOR COMPANY DETROIT, MICHIGAN

Turning the Wheels of a Century Hence—III

(Continued from page 60)

horse-power. We want to use it. We want to keep it for our own, but to have it developed for us by individuals or corporations which know how, and which, naturally, want to be paid for their knowledge. Let us, therefore, enact such legislation as will foster water-power development; let us repeal such legislation as interferes with it. Let us take the red tape off the water wheel and let it turn and let us do it now—now, when coal is expensive and transportation vital and prices high and inexpensive power badly needed.

To do this we need a water-power bill which will help develop water power with private capital; charge the government with a certain amount of water-power development; develop the power now running to waste in national forest and other government-owned or reserved lands; conserve the rights and interests of the nation; make available our power as a measure of national preparedness for war; make our power sites revert to the nation, no matter how developed or what private capital is interested, in a sufficient period of years; and provide for an accurate, elaborate and complete report upon the available water power, natural and undeveloped, the possibilities of power to be developed by storage, and a continuing census of power statistics which will be at all times available to interested capital and to the government.

To this end, every power user should interest himself in the bill now before Congress, and use whatever influence he possesses to its passage, and what is more important, its speedy passage. The water wheel is as old as civilization. The United States has untold wealth running to waste every second of the day in undeveloped power. The high cost of living is partly a high cost of labor and labor is but another word for power. That we, supposedly the most progressive of nations, should have a great power source but partly developed, when we might have millions of horse-power turning our wheels without depleting our already exploited coal and oil fuel, is an economic crime.

In the last analysis, governments do what the people under those governments demand. This government will develop or cause to be developed the water power now wasted when, and not until the people of the United States demand it. That demand is voiced only by individuals and associations. It is voiced by letter, word of mouth, newspaper publicity and telegram. It can be made effective only when it is large in volume, and large volume of voice comes from individuals, of which number you, the reader of these pages, are presumably one.

Power affects us all. Power is the root of our civilization. Power makes us great, and as it is cheap and efficient so is the process of living inexpensive and happy. To waste human power is to waste life itself; to waste national power is to drain away a nation's life for nothing.

What will *you* do to conserve and develop the wasted power resources of your country?

Fighting Waves with Compressed Air

(Continued from page 61)

there were more safe harbors. Under the protection of compressed air, piers can be erected and maintained in any location, no matter how exposed, and vessels can ride there and be unloaded, no matter what weather conditions prevail.

Nor are these all of the uses of such a protecting system. It can be used to build up beaches, or to make them safe for bathers, and furthermore it does not destroy the appearance of the beach or make it unsafe and unsightly, as groins do.

But the greatest service of all, perhaps, is the protection that can be given to boats and workmen in exposed places. The erection of breakwaters, piers, lighthouses and dams may be continued steadily, no matter how the white caps may toss. Think what such a system as this would have meant to old Captain Smeaton as he battled to make a lighthouse stand through the stress and storm on the wave-washed rocks at the entrance to Plymouth harbor. With the compressed air machinery working steadily, ample protection is given the builders.

What About Our Forests?

(*Continued from page 62*)

the New England states is still forest land, in spite of heavy cutting and dense population. But careless woodsmen have done almost irreparable damage there. A recent scientific investigation revealed the fact that about half of all the fir in this territory, as well as in eastern Canada, is dead or dying, from insect pests and disease.

The reason assigned for this is that when wood was plentiful the woodsman scorned the fir tree, or balsam as it is called in Canada. The firs were left standing and other trees cut out around them. For a while the firs grew luxuriantly in their isolation but through this very fact has come their downfall. Insects and diseases to which the fir is peculiarly subject spread rapidly because there were no other trees to halt them and the result is that nearly all of this valuable lumber will be lost.

A relative of this tree, the Douglas fir of the West, now is one of our principal sources of lumber supply. The yearly harvest in the state of Washington alone now is about 6,000,000,000 board feet and in Oregon another 1,500,000,000 feet.

There are still large forests in the East outside of New England. State Forester Gaskill of New Jersey recently pointed out that there are 2,000,000 acres of woodland in his state and that the possibilities in these are now almost wholly neglected. New Jersey, he says, has a favorable climate for the growing of trees, much land unfit or ill fitted for agriculture, and close at hand markets for all the lumber that can be produced. Even on the so-called pine barrens in the southeastern part of the state, the growth of trees is rapid. Trees need little more care than protection from fire; and fires, even in New Jersey, rival the lumberman in destructiveness.

Some few states have already adopted forest policies but at present we are planting only one tree for every 10,000 that are cut down. There is nothing mysterious in successful forestry. Most European countries have followed the practise for many years of planting a tree for every one cut down. Only mature trees are allowed to be cut so that the forests are perpetual. It is true that much lumber is imported from this country but our own supplies have reached the point where we can continue our wasteful methods only at the greatest peril to the nation's future.

Europe's methods of reforesting are perhaps too costly for immediate adoption here but adoption of a real national program would undoubtedly bring the country's production of timber up to our needs and would prevent needless waste.

For instance it has been found that the best policy in the Douglas fir lands of the Northwest is to cut off the timber clean, perhaps leaving an occasional seeding tree. Then at the right season the land is burned over to destroy pests. This treatment results in a good stand of young trees and thereafter they need only protection from fire to produce 1,259 board feet of timber per acre each year while the trees are maturing. This involves very little expense and labor, aside from supervision and fire protection, and provides a paying crop on land which might otherwise have become a barren waste.

If immediate steps are taken to care for these mighty forests of the Northwest the nation will be insured a continual lumber supply. If we continue our present course it will be only a matter of a few years when these forests will be in the position now occupied by the southern yellow pine forests. It is estimated these southern forests will be gone in ten years and that within seven years 3,000 manufacturing plants in the South will be forced out of business because of this fact.

To quote from a bulletin of the American Forestry Association:

"Within fifty years our present timber shortage will have become a blighting timber famine.

"Forests can be protected from fire, regrowth can be encouraged, conservative cutting can be practised, restoration can be accomplished—but it takes from fifty to a hundred years to mature a timber crop.

"Forest devastation must be stopped, lands now in forest must be kept continuously productive, forest lands now devastated and idle must be put to work."

It is a timely warning. The man who wishes to help need not go to the Northwest to do it. There are woodlands and trees in every community that need to be recognized as a valuable asset and given protection accordingly.

"Resolute" Defends the Cup

(Continued from page 64)

that "Resolute" makes 9.25 knots over the actual distance sailed to windward, and 11 knots to leeward and that "Shamrock" saves 4 minutes of her handicap up the wind and two minutes down wind. To do this she would have to make about 9.6 knots to windward and 11.3 knots to leeward.

The assumed speeds are high, especially to windward; but they will serve the purpose of showing the task which "Shamrock IV" will have to perform if she is to save six minutes over the fastest boat for her length that we have ever turned out on this side of the water.

"Shamrock" has an excess of 20 per cent of sail area; but she labors under the disadvantage of a great excess of wetted surface. Moreover, the American boat has an easier form to drive, especially in reaching and running. On the other hand, looking at the problem broadly, the average yachtsman will tell you that as between sail area and time, he would choose the sail area.

The Man Behind Our Daily Bread

(Continued from page 66)

weighing buckets and quickly returned to the bags after passing inspection.

The scales used in weighing are of the balance type. The grain is poured from the testing pan into a stationary funnel which is closed at the small end with a slide. When this slide is opened the grain pours down into a brass bucket which has a capacity of an even quart when leveled off. The bucket of grain is then attached to the scales, the reading bar of which has arbitrary figures showing what the grain will weigh a measured bushel. The inspectors must ascertain the weight of a measured bushel of grain inspected by them and report the same in their records, because weight is an important factor in arriving at a final decision on the quality of the grain.

After the grain is weighed it is carefully examined to determine its grade, and the inspector marks on a card with a printed form the grade number and kind of grain with notations and weights. This card is enclosed in the bag with the grain, and the clerical force makes a detailed record which is kept on file so that if a shipper at any time requires an inspection certificate it is issued upon request. The clerical department issues two certificates on every car inspected, which go to the receiver of the grain in Chicago, and he, in turn, sends one to the shipper and one to the buyer of the grain.

These certificates are issued on the day of inspection for the convenience of the trade in general. Half of the actual sample of grain inspected is retained in the offices of the Inspection Department and half is placed in a paper bag and sent to the grain commission merchant to whom the grain was consigned. The commission man uses this for his selling sample on the exchange floor of the Board of Trade.

In addition to the tests given other grain, corn is put through the moisture-tester. This method was not universally employed until in recent years, and its importance was augmented by the standard system of grading corn authorized by the government a few years ago. The amount of moisture contained in corn is a matter of great concern to the man handling it, and grain which in all other respects appears excellent has to be graded low when it is filled with water.

Corn containing much moisture does not keep as well as when dry, as it is apt to heat, sour or mold. Elevator people do not like to store it for this reason, and in warm weather it can be shipped only at considerable risk. The various industries engaged in the manufacture of corn products also prefer dry corn for economical reasons. The weather at the time the corn is harvested is a big factor in determining the amount of moisture it will contain, but corn absorbs moisture so readily that care must be used in handling it at all times.

The apparatus used for determining the amount of moisture in corn is simple enough in its operation yet truly wonderful in its achievement. Its principle is to boil the water out of the corn and condense it. This is accomplished by placing the corn in a glass container or distillation flask with a certain amount of mineral engine oil. These flasks are globular in shape with a neck at the top and a long narrow glass tube running from near the bottom of the neck. The flasks have a capacity of approximately 1,000 cubic centimeters, and are of the best grade of resistant glass and well annealed in order to withstand sudden changes in temperature without breaking.

After the bulk sample is properly mixed, the desired quantity for the moisture test is carefully weighed and emptied into the distillation flask with the necessary quantity of oil. In the case of corn, 100 grams by weight of the grain is used to 150 cubic centimeters of oil; with oats, 50 grams by weight to 150 cubic centimeters of oil. As soon as the grain and oil are placed in the distillation flask they are thoroughly mixed by shaking them. A thermometer, with rubber stopper attached, is then placed in the neck of the flask and the grain and oil heated to a temperature of 190 degrees Centigrade, after which the flame is turned off and the mixture allowed to cool about twenty-five degrees. The moisture in the grain turns to steam during this process and the only means of escape for the steam is through the tube of the flask. This tube is connected by a rubber stopper and runs through a tank of cold water. Thus the steam from the grain is condensed as it passes through the cold water and drops into a graduate below. The reading of this graduate when the grain has cooled completes the test.

Corn that shows only 14 per cent moisture is graded No. 1. If it contains 15.5 per cent it is graded No. 2; if 17.5 per cent, No. 3; if 19.5 per cent, No. 4; if 21.5 per cent, No. 5; and if 23 per cent, No. 6. Should the moisture content exceed 23 per cent it is classed "sample grade." About half an hour is required to determine the moisture content in each sample.

In determining the grade of corn there are other things besides the moisture test to be taken into consideration. These are damaged kernels; foreign matter; corn that is hot, heat-damaged, fire-burnt, sour, musty, immature, blistered, or infested

with live weevil. "White corn" must be at least 98 per cent white, and "yellow corn" at least 95 per cent yellow. The grades of wheat are determined by the variety, winter or spring (which mean, respectively, wheat sown in the fall and spring), hard or soft, and by soundness, plumpness, dryness, sweetness, weight, and also its degree of cleanliness. Color likewise is an important factor in grading wheat. Rules for grading oats, rye and barley are largely the same as those applied to wheat.

Preventing the Oxidation of Metals from Heat

THERE are numerous places in which the ordinary means of preventing metal from oxidizing are futile. The leading electrical manufacturers, for instance, have long recognized the need for better protection of the various heating elements from this type of destruction; for in some cases these elements are exposed to oxygen in the unusually active form of ozone, created by the electric current itself, and even when his complication is absent, the extreme temperatures to which heating elements may be raised must necessarily make the oxidation problem an acute one. Another instance of similar exposure is found in mechanical soot-blowers for boilers, which are subjected to hard and continuous service at boiler temperatures, in the presence of hot gases of all sorts, and under the additional stress of mechanical contact with quantities of soot. And these are but examples showing that the ordinary resistant metals are not always sufficiently resistant to oxidation under acute conditions.

Several years ago one of the large electric companies, in view of this state of affairs, instituted a research for the development of some process of treatment that would render metals more resistant to oxidation at high temperatures. At the present time the process has reached a stage where this company is using it regularly; it has been tried out in several other connections, notably that of soot-blowers already mentioned; and it seems so promising that a company has been formed for the sole purpose of commercializing it.

The process, to which the name "calorizing" has been applied, depends upon the high heat-resistance of aluminum oxide. The parts to be treated are packed in a retort with an alumina mixture and other chemicals whose identity is not for the present divulged; hydrogen gas is introduced into the retort; and the temperature is then brought gradually up to 1650 degrees Fahrenheit in the electric furnace. After holding the heat at this point for a proper time, the retort is allowed to cool slowly, the introduction of the hydrogen still continuing. When cold the treated parts are withdrawn and cleaned. It is then found that the alumina has penetrated the surface metal of the treated parts to a greater or less degree, depending upon the time through which the process is allowed to extend. A homogeneous protective alloy is thus formed with the surface metal, not unlike an amalgam. This alloy shell is strongly resistant to the oxidizing influence of heat, and at the same time no physical change is apparent in the calorized portion of the metal, with the exception of the mild anneal resulting from the heating in the furnace. In particular, there is not the slightest tendency of the protective shell to strip or otherwise to behave as anything other than an integral part with the metal beneath it.

Over $100,000 has bee nexpended in developing the proper character of furnaces, retorts, mixtures and handling, and the development of the calorizing process has been brought to a high point of efficient application. During the past two years thousands of parts have been calorized for many of the largest industries of the country and the plant has been visited by many eminent chemists and metallurgists, as well as by mechanical experts, who were interested in observing the process in operation and determining the results by first hand investigation. Their reports have been enthusiastic and they generally predicted a large use for calorizing among industries experiencing heat-oxidation problems.

Where high temperatures in combustion are employed, ranging up to 1800 degrees Fahrenheit, calorized metal is said to give most excellent results. The ideal temperatures for its use range from 1100 to 1750 degrees Fahrenheit, and at 1800 degrees the resistance to oxidation from heat very sliwly diminishes. Close-grained cast iron, black and wrought iron, steel, nickel, nickel-steel, brass, bronze and copper have been successfully calorized and a much longer life incorporated in their use in high temperatures. A large application is seen in relation to calorizing of annealing and carbonizing boxes, pyrometer protection-tubes, retorts, super-heaters, vaporizers, burner collars, pipe and tubing, and a multitude of other uses among many industries. Calorizing is not a preventive of atmospheric oxidation, or oxidation from moisture. It has wonderful resistance, however, to oxidation from heat, up to 1800 degrees Fahrenheit, and assures a much less frequent replacing of equipment or machine parts, with elimination of the considerable labor cost involved and loss of production resulting from laying-up of equipment.

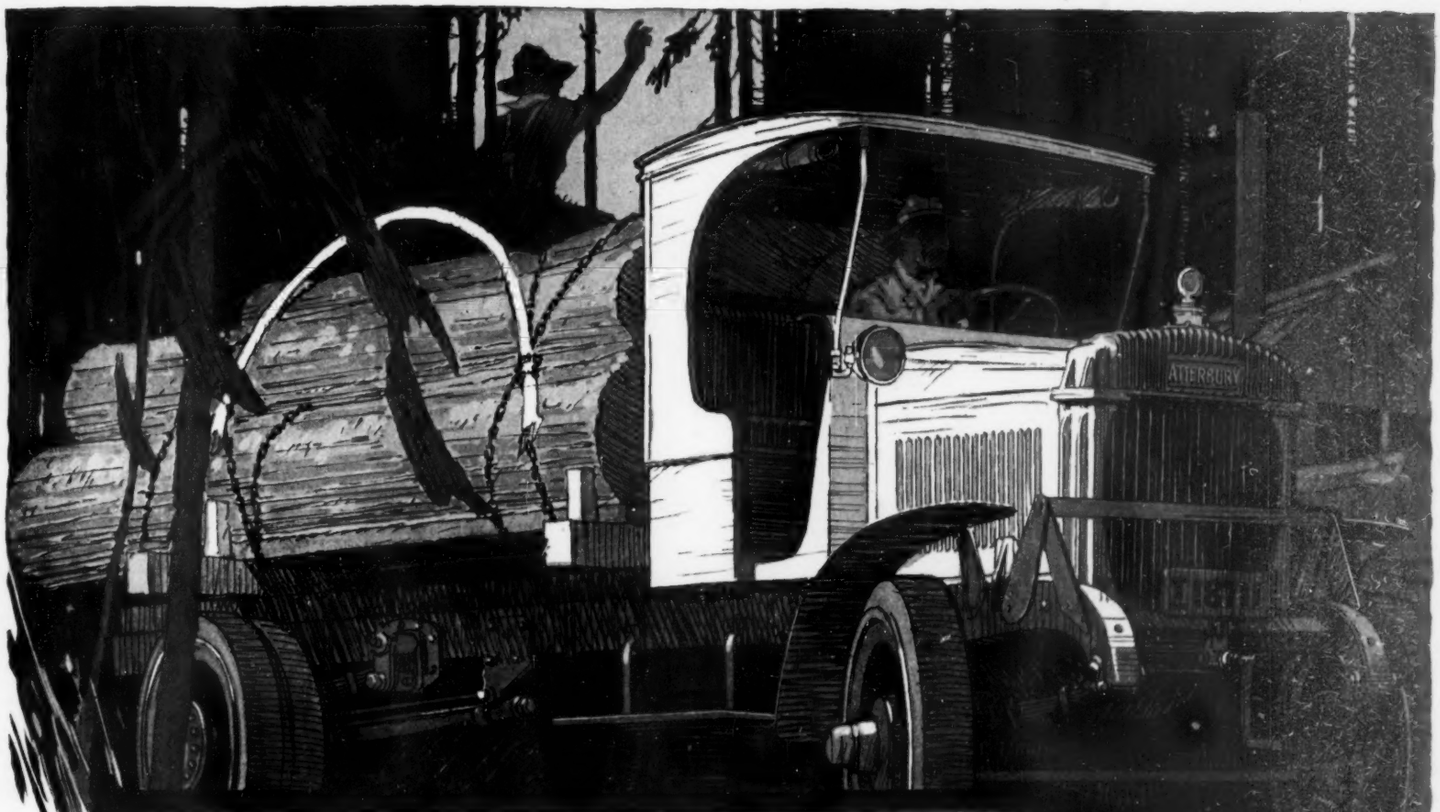
Ball Bearings in Steamship Engines

THE Swedish ball bearing manufacturers, after introducing successfully ball bearings in Swedish rolling stock, especially the Swedish State railways, are now entering new fields of experimentation, which have for their object the introduction of the ball-bearing principle in ship construction, especially in connection with propeller shafting. The problem completes the construction of a bearing able to withstand all axial pressure from the propeller and excluding all possibilities of hot box and kindred troubles. The successful ball bearing, it is claimed, must under the most trying conditions be able to withstand the axial pressure automatically and require little or no attentio nand must be of such simple and reliable construction that friction within the same is minimal and that the ship's movements may not influence disadvantageously the ball-bearing mechanism.

While ball bearings are used to a considerable extent in marine engineering, their application and their mounting have seen their highest development in Swedish shipyards. This is the contention of Swedish shipbuilders generally, but will doubtless meet challenge in the United States and Great Britain, where shipbuilding yards have not been slow to see the advantages offered by ball bearing.

Invention in Flashlight Photography

IN the *Times'* report of a meeting at the Royal College of Science, a demonstration in flashlight photography was given by Mr. K. Hickman. A "snap" of the audience was taken and a photograph of the chairman. The plates were then given a rapid development, with a lightning wash; fixation in afixing solution which was effective in 30 seconds, an invention of the lecturer; a further washing for 2 minutes, in which time the hypo was removed by dilute permanganate; a bath for 2 minutes in formalin solution, after which the plate was rinsed, dried in a stream of hot air from a machine of the lecturer's design, and finally printed on a lantern plate. Within half an hour of the exposure, a lantern-slide photograph of the chairman was projected onto the screen. Mr. Hickman also dealt with the screen-plate method of color photography which, he said, by its simplicity and the beauty of its productions, had ousted all other methods for amateur work.



"Maximum Service"

Soundness of design and staunchness of product carried the Atterbury Truck through a test run over 5000 miles of good and bad roads *without loosening a nut.*

Such a record could never have been attained without soundness that extended clear to the foundation of Timken-Detroit Axles.

Makers of fifty-five well known American Motor Trucks agree that no axle but Timken-Detroit is good enough for their product.

Abbott & Downing	Brockway	Gary	Master	Paige-Detroit	Sullivan
Acason	Chicago	Hahn	Michigan Hearse	Parker	Tegetmeier & Riepe
Ace	Clydesdale	Hendrickson	Minneapolis	Sandow	Tower
Acme	*Denby	King-Zeitler	Moreland	*Seagrave	Walker-Johnson
*Ahrens-Fox	Diamond T	Kissel	National	Selden	Ward-LaFrance
Armleder	Dorris	Kleiber	Nelson & LeMoon	Service	White Hickory
Atterbury	Fageol	Koehler	New England	Signal	Witt-Will
Available	Federal	Lewis-Hall	Oneida	Southern	Wilson
Brinton	Garford	Locomobile	Sterling	Standard	
	G. M. C.	Maccar			

**Front Axles*

THE TIMKEN-DETROIT AXLE COMPANY, Detroit, Michigan

TIMKEN-DETROIT AXLES

General Motors Trucks

WHEREVER the big important jobs are to be done you will find GMC Trucks. It is in the strenuous work that reliability is needed most.

Reliability, along with other motor truck requirements, depends on quality, and quality is the first GMC virtue.

For the sake of such quality nothing is ever sacrificed. Quality comes first. It is built in at the factory. It comes forth in faithful performance.

Those who know GMC Trucks best appreciate most what these statements mean.

GENERAL MOTORS TRUCK COMPANY
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PONTIAC, MICH.

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